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Volume XXIII OCTOBER, 1942 No. 10

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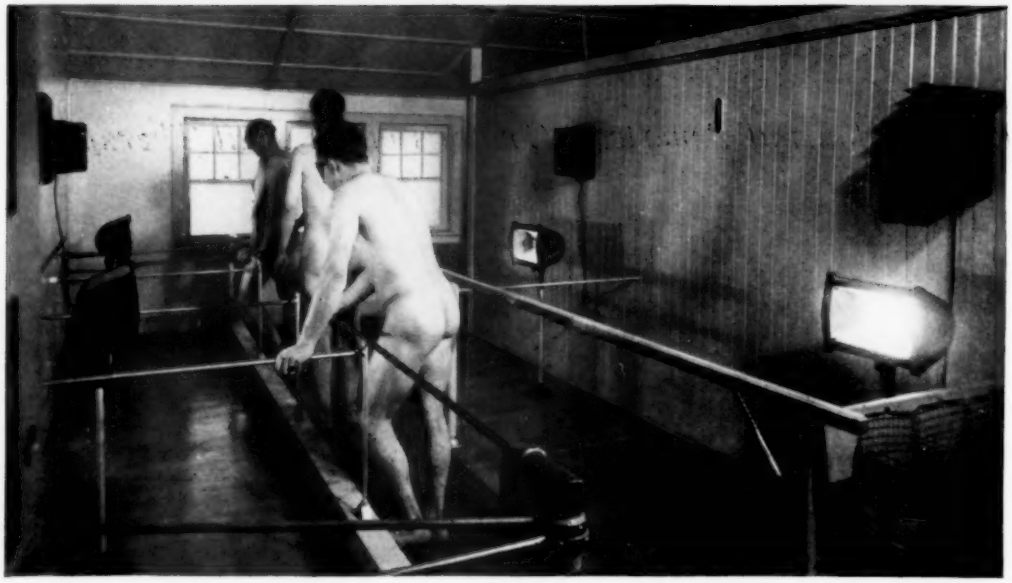

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EARL C. ELKINS, M.D.

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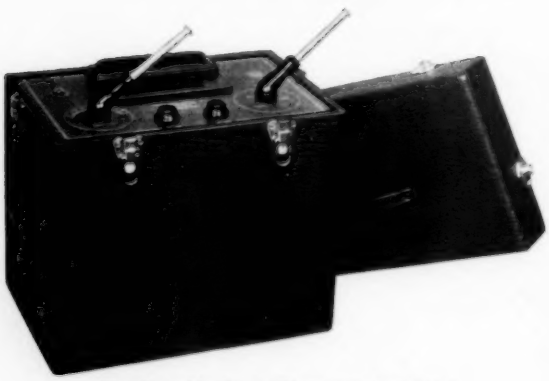

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REFINEMENTS IN THE TREATMENT OF ARTHRITIS ESPECIALLY IN RELATION TO PHYSICAL THERAPY *

RALPH PEMBERTON, M.D.

PHILADELPHIA, PA.

I have chosen for my subject "Refinements in the Treatment of Arthritis, Especially in Relation to Physical Therapy." It is perhaps not inappropriate that at a congress of physical therapy some attention should be directed, on the one hand, to that syndrome which probably bulks larger in the field of physical therapy than does any other single disease entity, chronic arthritis; and on the other, to refinements in the application of Physical Therapy intimately related to the disturbances in physiology which characterize that disease.

In the protean field of arthritis there is necessity for those who treat the disease to appreciate more fully than is now generally the case the various subtleties which constitute the syndrome. The writer and his associates are convinced that much that is brought to bear upon arthritics conforms in a titular sense to the proper prescription but falls far short of that kind of exhibition which achieves the results desired. This is not the fault of anyone in particular but derives from the fact that the syndrome is so varied that, relatively few persons have the interest or the time to follow to a logical conclusion, or even to recognize, each deviation which presents. The abstract desirability that the disease should be handled with the greatest finesse, with the aim of alleviating what is now known to be the greatest medical-sociologic burden, is now sharply exacerbated by the war, not only in respect to the armed forces but equally in respect to the civilian population, already handicapped by a growing dearth of medical care.

Lessened Emphasis On Infection

Those who have followed the rapid development of the problem of arthritis and rheumatoid diseases in the medical mind, realize that the dramatic emphasis placed, until recently, upon the rôle of focal infection in precipitating the syndrome has now been greatly lessened. So much is this the case, indeed, that there is now grave danger that iconoclasticism of an opposite nature toward infection may work great evil before the pendulum of opinion comes to rest at a mean point. However, the fact that focal infection is no longer regarded as the ultimate cause of the disease now makes it obligatory to look elsewhere for etiologic and therapeutic influences and to consider more openmindedly many dislocations of physiology which have been too long overlooked or ignored. Henderson well said at the bicentennial celebration of the University of Pennsylvania in 1940 that "the discovery of specific pathogenic micro-organisms seems to have led back to an over-simplification of thought about the origin and nature of disease," and his main thesis was that the origins and causes of disease are multiple rather than single.

As enunciated fourteen years ago by the American Committee for the Control of Rheumatism, arthritis is a systemic disease with joint manifestations. It is distinctly not, primarily, a disease of joints. When it comes to defining the basic nature of this systemic disease, however, one enters upon more difficult ground. The tissues involved are chiefly, if not entirely, those derived from the mesoderm and something might be gained if the syndrome of arthritis were designated by some such term as mesodermosis. Such a term could perhaps not be

* Read at the Twenty-first Annual Session of the American Congress of Physical Therapy, Pittsburgh, Pa., September 11, 1942.

fully supported and yet it suggests more of the complex than is suggested by the term arthritis, inasmuch as many patients suffering from the arthritic syndrome may present little or no true arthritis.

Without going into details, there is evidence that the disease is basically one of imbalance of the central nervous system of the body, using that term in its widest sense to include also the endocrine chain as a whole. There is also a large number of factors operating to precipitate or perpetuate the disease which must be reconciled one with another if any integrated hypothesis is to be entertained. To allocate a different cause for each of the features of the arthritic syndrome is to create a chaotic situation which had better not have been attempted. Unless these features can be referred to some reasonably common denominator, the picture of arthritis must remain more or less disjointed. In this connection it is, therefore, well to call attention to the following considerations.

The manifestations of arthritis, especially of the atrophic or rheumatoid type, are usually symmetrical, or at least tend to become so. This is also the case in hypertrophic or osteo-arthritis, though to a somewhat less extent, in that trauma may play a locally aggravating role. The low-grade edema which the majority of arthritics present is also of systemic and symmetric distribution. Such manifestations of the syndrome as the cold, leaky hands of the arthritic are obviously also symmetric. The growth of cartilage or bone in various peripheral tissues such as the phalanges, the development of pannus which destroys cartilage, and also the development of granulation tissue of the bone marrow which undermines the cartilage, are also largely symmetrical in distribution and it is clear that local factors could not, alone, account for these phenomena. There is general agreement that infection of the joints themselves has not been demonstrated.

More specifically, definite evidence of the influence of a neuro-endocrinous chain is to be seen in such phenomena as the exacerbation of arthritis in women contemporaneously with or immediately prior to onset of the menstrual cycle; the incidence of the arthritic process in women at the time of the menopause; and retrogression of the arthritic process in women during the course of pregnancy. Further evidences, not so graphic and requiring more detailed presentation than is possible here, are to be seen in the hereditary trend, in various forms of imbalance of the nervous system in many arthritics, vaso-constriction of the capillary beds at the periphery, lowered and delayed reactions to environmental temperature, imbalance of the neurogenic control and atony of the gastro-intestinal tract, low basal metabolic rate, the asthenic build of the atrophic type, history of over or under development in some cases, and other features. It can be said with considerable confidence that anyone desirous of visualizing the rheumatoid syndrome in its entirety must be prepared to recognize the possibility that central factors play a determining role in the disease when viewed in long-range perspective. Certain it is that no narrower or uni-directional envisagement of the problem can account for the manifestations of it.

Morbid Anatomy of Arthritis

Increasing attention to the syndromes of arthritis is extending more widely knowledge of the gross pathological deviations of the disease which characterize the two great major types, atrophic and hypertrophic arthritis. It may be well, however, to mention in a preliminary way that atrophic (rheumatoid) arthritis is a disease of the first half of life; and hypertrophic (osteo-) arthritis, a disease of the second half of life. Both of these are, in the opinion of the writer, systemic conditions. In atrophic arthritis the disease is characterized, so far as the joints are concerned, by a smothering of the articular cartilage by a synovial pannus which overgrows it; and at the same time by an undermining of the cartilage by a granulation tissue springing from the shaft of the bone. When

these two processes involve articulating bones, ankylosis of a fibrous, cartilaginous or bony nature may result.

In hypertrophic (osteo-) arthritis, so far as the joints are concerned, the disease consists in degeneration of the cartilage by a process of fibrillation which exposes the ends of the bone. The bone ends become highly polished through friction and at the same time atrophy of the cancellous tissue takes place in the end of the shaft so that bending from pressure results. There is also a cartilaginous or bony overgrowth which, in conjunction with the influence of pressure, results in bizarre deformities.

Fibrositis illustrates the manifestations of the basic rheumatoid process in the muscular tissue and is characterized largely by the replacement of muscular tissue by fibrous overgrowth. Peripheral nervous tissue may also be involved, probably with a true neuritis, though the mechanism here is not so clear.

Deviations of Physiology

There is, however, far from adequate appreciation as yet of the disturbances in the great systems of the body, earlier referred to, which accompany, if indeed they do not actually underlie, the disease. It is partly in respect to these deviations of the great systems that justification derives for regarding arthritis as a systemic disease.

Some of these disturbances in the nervous and vascular systems have been touched on. There are, however, additional deviations in the blood and hemopoietic system, characterized by a shift to the left in the blood formula, and disturbances in antigenic factors such as agglutinin reactions to streptococci. In the gastro-intestinal tract, recent studies[1] have revealed a high incidence of hypo- or achlorhydria, disturbance of gall bladder function, ileal stasis, and a combination of atony and spasticity of the colon, accompanied by elongation, dilatation and tortuosity. The deviations in these systems are often subtle, requiring careful scrutiny. They definitely deserve closer attention than they have received and it is in respect to such dislocations that a greater refinement of therapy can be brought to bear, the net result of which is to bring about, at least to some degree, a condition of equilibrium. It may be said, indeed, that arthritis consists in large part in the necessary consequences of these varied deviations and that to correct the deviations is to correct the arthritis.

Rôle of Physical Therapy

It is precisely here that the field of Physical Therapy offers much of value. It should be added, in all fairness, that when Physical Therapy is directed toward a fracture, for example, the assumption can confidently be made that orthopedic direction has properly aligned and immobilized the fragments. So much cannot, however, be necessarily assumed as to general medical appreciation and direction of the problems presented by arthritis, and practitioners of Physical Therapy to whom such problems are referred should see to it that the ground is equally well paved for their own ministrations.

It is now widely appreciated that with the exception of radiation from radium or x-ray, the essential basis of physical therapy consists in the quartet of heat, massage, exercise and rest. The ordinary conception of physical therapy, is of something which must necessarily be active and even aggressive toward the individual. This is, however, partly a misconception. A necessary feature of physical therapy is rest, which is just as essential to conduction of it as rest is essential to the contraction of muscle. There is scant understanding of the importance of this premise. It is therefore important to inquire wherein rest, especially as regards the arthritic patient, does actually consist. Rest in recumbency accomplishes the following:

(1) Promotes even distribution of blood throughout the capillary beds.
(2) Permits passage of tissue fluids into the vascular channels.
(3) Releases the nervous system from maintaining erect posture.
(4) Allows ptosed and dysfunctioning organs to assume normal positions and functions.
(5) Reduces the metabolic load necessary to the supply of energy.
(6) Permits replacement of the metabolic factors characterizing fatigue.

There is no time to consider each of these influences ad seriatim but let us consider more closely No. 2, for example. One of the chief and least appreciated features of the arthritic syndrome to be observed under refined study is the low-grade edema which affects peripheral tissues and possibly others. It is probable, indeed, that this excess of tissue fluid constitutes part of the actual pathology of the disease and accounts for much of the stiffness and possibly the pain experienced by arthritics. This edema may entirely escape notice, however, until it begins to disappear under the influence of rest or other factors. This phenomenon is most easily to be seen in the hands where, in many arthritics, the inter-osseous spaces reappear, motion of the tendons becomes visible, the skin becomes loose on the fingers and hands and, finally, a condition resembling collapse appears in relation to the fourth and fifth metacarpal bones. Edema in the region of the wrist subsides more slowly and an annular tumefaction may persist there for a long time. Fluid will equally leave other parts of the body, though less obviously. At the pretibial regions a low-grade tissue edema, sometimes to be detected by forcible pitting, can also be seen to grow less.

The purpose of detailing this is to develop and correlate with other agencies the influences of massage which, as is now well recognized, may induce a definite diuresis. This diuresis is not constant, however, and technicians who give massage to patients in bed often feel, not unnaturally, that the massage accounts for the benefits achieved but sometimes the rest alone explains the progress being made and, indeed, at times massage hinders and prevents the progress which would otherwise ensue. If the massage be too severe, the tissues may undergo traumatization, even though of minor nature, sufficient to delay loss of the fluid concerned. Only when the massage is too vigorous in a more general sense do discomfort and pain signalize this fact.

Dependence should not be placed upon one measure alone to meet this condition of low-grade edema. In addition to rest and massage, other factors, such as sweating and purgation, also have influence. Sweating comes definitely within the purview of Physical Therapy and is probably not adequately used in sthenic arthritics. Some of the spas of Europe achieve their results by means of it and the influence of sweating should be understood and carefully controlled. The question is not one of eliminating fluid alone because that purpose might be defeated by the subsequent drinking of water. Exposure to heat brings about other reactions, which cannot be discussed here, also instrumental in inducing a form of "hyperphysiology" involving the tissues as a whole.

More basic than either sweating or purgation, however, and much safer in its operation, is the question of proper alimentation. In the arthritic presenting a low-grade edema it is possible so to balance the food intake as to make toward or away from this tissue edema. This influence is widely overlooked and instances are legion in which the patient is advised to take sweat baths or undergo massage quite independently of the influences just mentioned. There must at all times be adequate solicitude for the caloric necessities of the individual but, unless there is some contra-indication, a diet high in protein, reasonably high in fat, high in green vegetables and fruits and somewhat restricted in concentrated carbohydrate foodstuffs will slowly but persistently withdraw fluid from the body. This influence will obtain even though the food intake be entirely liquid

in form. The metabolism of protein requires water for elimination of the metabolites resulting and in the metabolism of fats, water is lost in the chemical steps necessary to this end. On the contrary, if carbohydrate be fed in large amounts and if the individual stores this in the form of glycogen in the liver and muscles, water will be retained. Removal of tissue fluids under these circumstances will be more difficult or may be prevented, even in the presence of the sweat process and the exhibition of massage, both of which may then appear to be without benefit or worse.

As already mentioned briefly, it is clear from observations on the gastrointestinal tract of arthritics in a recent study of 400 cases by Spackman, et al (loc. cit.), and from other studies, that the arthritic of either type may show hypo- or achlorhydria, dysfunction of the gall bladder, ileal stasis, and dilatation, elongation and tortuosity of the colon, sometimes accompanied by local spasticity. This situation bears upon the use of Physical Therapy in the treatment of arthritics because, in the first place, some arthritics present great abdominal tenderness, chiefly perhaps along the line of the descending colon which may be spastic and tender because of that or dilated and tender because of distension. The head of the cecum may also be tender and in the course of general massage these considerations should be kept in mind. Furthermore, in spite of many facetious allegations to the contrary, there may be real benefit from colonic irrigation in certain selected instances. Under therapy of this nature, properly conducted at skilled hands, the tenderness referred to usually disappears.

It is to be regretted that the indifference of the profession to the influences available in this way have driven the laity to more obliging but less educated practitioners to such an extent as to have brought opprobium upon this measure.

Another of the influences of rest in the Table outlined above which will bear particularization is that which permits relaxation of the nervous system by releasing it from the work entailed in the maintenance of muscular tone. Here again there should be full understanding on the part of the physical therapeutic technician as to the extent to which relaxation really exists in the case in question. To this end there should be closer collaboration with the physician. Most arthritics worthy of the name are fatigued by the necessity of carrying on and when admitted to hospital for sustained treatment should be subjected to rest and, usually, pharmacologic sedation at the outset.

It is well recognized that massage should not be instituted following trauma in its early stages except under most guarded conditions. By the same token, massage or heat to the arthritic should be brought to bear only when the patient is in position to benefit by either. Massage cannot be constructive unless the proper response be available and this is not the case until something approaching an equilibrium has been achieved in the tissues in question.

The Training of Technicians

As a result of many years of experience, the writer is convinced that most Physical-Therapeutic technicians, thoroughly well trained otherwise and presenting the highest qualifications, do not adequately appreciate the subtleties that present in the field of rheumatic disease. Indeed, it is the belief of the writer that, just as Physical-Therapy technicians are taught the pathology of fractures and dislocations before being permitted to treat them, so they should be taught more fully the general outlines of the gross morbid anatomy and dynamic pathology of the rheumatoid syndrome.

Hypertrophic arthritics are most apt to suffer in this way and there is scant appreciation of the fact that rest in bed alone will achieve more than Physical Therapy can for most of these individuals until certain phases of convalescence have been inaugurated. A frequent result of Physical Therapy either from heat or massage in hypertrophic arthritis is to aggravate the symptoms by trauma.

This is not to say that hypertrophic arthritics do not need Physical Therapy. In the opinion of the writer they do because they suffer from many such features as anemia, atrophy of muscle, inadequate or deviated circulation, low-grade edema and other factors, but they need such therapy under conditions of the most intelligent restraint.

By the same token, the subject of active atrophic (rheumatoid) arthritis should be encouraged to move his involved joints, voluntarily only, through their possible range of motion once or twice daily. This can best be accomplished with the oversight of a trained technician but great danger attaches to passive motion even at skilled hands, and Physical Therapy technicians usually need sharp guidance in this respect. Postural exercises, especially to spondylitics, are of great importance. Few technicians have any familiarity with this field although it involves influences and measures immediately parallel to those which they practice. Every Physical Therapy technician who attempts treatment of arthritics should be thoroughly grounded in this indispensable aspect of therapy.

There are other phases of the arthritic syndrome bearing more or less relation to the field of Physical Therapy which could be detailed. Enough has been said, however, to suggest that the field of arthritis presents more phenomena and delicate situations than the profession as a whole realizes. Only when consideration of these is actively entertained can *any* therapy be expected to function optimally and of no other is this more true than as regards Physical Therapy.

Perhaps the purpose of this brief presentation can be best developed at this point by setting forth the general sequence of steps which, in the opinion of the writer, should be followed in the treatment of arthritics as a group, so as to illustrate in general the position which Physical Therapy should occupy.

(1) Rest, systemic as well as local.
(2) Sedation and/or stimulation.
(3) Optimal nutrition in the refined sense earlier discussed.
(4) Proper gastro-intestinal function.
(5) Examination of the blood and body chemistry.
(6) Time for establishment of a general equilibrium.
(7) Examination for foci of infection.
(8) Medication, such as iron, arsenic, etc.
(9) Treatment of foci, conservatively.
(10) Use of Physical Therapy, conservatively — meaning chiefly intelligently directed rest, heat, gentle massage and postural exercise.
(11) Orthopedic help.
(12) Endocrine therapy in selected cases.
(13) Psychic re-education.
(14) Last, if at all, vaccines, gold, etc.

In detailing this sequence there is danger of conveying to the reader the thought that treatment can be reduced in fact to such simple measures as the titles seem to suggest. As indicated under the sub-heading of rest in this Table, much more is implied in each subdivision of the Table than is apparent in the title. However, even with fragmentary appreciation of all that is included under the several steps indicated, adherence to a purposive order of approach such as is here outlined can result only in benefit to arthritics as a whole. At least no danger can follow, by and large, and the only deterring factor is that consequent upon the belief, common in many medical minds, that the prescription of rest or optimal nutrition means nothing more than the hackneyed connotations usually entertained. The worst that can happen to arthritics treated along this line is that they may fail of experiencing as fully as possible the basic influences intended.

The above attempt to relate the causation and symptomatology of the disease to centrally controlled factors of the nervous system, including the endocrine chain, makes it possible, at least in a fragmentary way, to account for a considerable number of the symptoms of arthritis, and also to afford a raison d'etre for some measures of therapy which have pretty well defied explanation. At all events, anyone who wishes to see the syndrome whole and is willing to bring an open mind to contemplation of the problem must recognize that the mechanism suggested cannot be waived aside. We are far from possessing data which could attach final significance to such an hypothesis but we are equally far from data which could justify failure to consider it. This is not to be taken as a statement that arthritis is due to a deficiency of Hormone A or B, or an excess of Hormone C or D. However, if we consider only one factor in the endocrine chain, namely, the pituitary gland, it becomes evident that such phenomena as vaso-constriction, tissue edema, overgrowth of tissue, convalescence during pregnancy, the high incidence of arthritis at the climacteric, lowered metabolic rate, and other manifestations of arthritis can be reasonably referred to modifications in the normal influences of this tissue either alone or by virtue of its inter-relationship with the thyroid, adrenals and gonadal chain.

As earlier remarked, there has been of late much iconoclasticism towards the doctrine of focal infection. This factor nevertheless may play a significant precipitating and perpetuating role. It is clear that this role is not one of invasion of the joint tissues but rather one in which the localized infection makes demands upon the reactive and antigenic defenses of the body. It is by no means certain that these defenses are purely humeral in nature and there is evidence to suggest that these and other peripheral reactions of many sorts, are mediated by the demands made upon the central, controlling and inter-related mechanism above referred to.

A natural corollary to this is one which offers explanation of the supposed benefits of countless varieties of measures, chiefly injections, which have been brought to bear upon arthritics. These measures vary from Coley's fluid, unlimited form of vaccines, sulphur, non-specific protein, bee and cobra venom, and finally, the most popular exemplar of the day,— gold. It is impossible to negate all the benefits which have been alleged to occur following the use of any or all of these agencies. None of them is specific for the disease, they all have limited value, as is the case indeed also with gold, but throughout the whole series there is evident the stimulation of some kind of central mechanism which in a limited number of instances results in a reaction, abrupt or more sustained, which may prove beneficial.

Summary

Finally, it is the belief of the writer that if the syndrome of arthritis be regarded in some such way as is outlined briefly in this presentation, it becomes easier to understand what can and cannot be expected from such remedial measures as are brought to bear. On the basis of such an hypothesis those who treat the disease can be expected better to appreciate the inadequacy of treating joints alone and better to appreciate the wisdom and necessity of bringing into balance the great systems of the body. In the effort to this end, Physical Therapy does and should occupy a high place. The somewhat removed and mechanical rôle which it now plays, however, develops only a fraction of its full theoretical value and, in the opinion of the writer, Physical Therapy could and should be more philosophically integrated, along the lines which have been discussed, with the physiological deviations of the syndrome.

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Presidential Address

THE FUTURE OF PHYSICAL MEDICINE *

FRED B. MOOR, M.D.

Professor of Pharmacology and Therapeutics, Medical School and Director, School of Physical Therapy, College of Medical Evangelists, Loma Linda and Los Angeles

LOS ANGELES

Introduction

In the midst of a stupendous world upheaval, it seems presumptuous to attempt to forecast the future in any field of human endeavor. Scientific truth does not change with social and political disturbances. It may be submerged for a time and temporarily forgotten, but it will eventually emerge, still the same. We may, therefore, venture to predict, with a reasonable degree of confidence, the future development of physical medicine, especially, since we believe that our country will be able to preserve the democratic way of life. In this attempt we shall be guided by the development of the other medical sciences and by the recent history and present trends of physical medicine itself.

The Experimental Method

Medicine began in superstition and empiricism. The heathen priest was the medicine man and accompanied his primitive medicine with incantations to his heathen god. Hippocrates is said to have been the first physician to throw off the superstition of the priesthood. Many of the ancient physicians were keen observers and have given us accurate descriptions of certain diseases, but their knowledge was limited to clinical observation and was not confirmed nor expanded by experimental demonstration. Hippocrates himself in his first aphorism admitted "experience fallacious and judgment difficult." This was the era of empiricism.

Although Galen is credited with the initiation of the experimental method in medicine during the second century A.D., the medical sciences really began to emerge from the era of empiricism into the era of rational experimental medicine with the anatomical studies of da Vinci and Vesalius early in the sixteenth century. They were followed by the physiologist, William Harvey, who in 1628, published his "De Motu Cordis et Sanguinis." Morgagni in 1761 reported his work in gross pathology, "On the Seats and Causes of Disease." A little later Lavoisier laid the first stones in the foundation of biochemistry. The experimental method reached its full stride in the middle and latter part of the nineteenth century. In 1848 Claude Bernard, the great physiologist, presented his study on "The Origin of Sugars in the Animal Body." In 1858 Virchow's "Cellular Pathology" appeared. In 1866 Pasteur published his paper on anthrax and in 1885 his masterpiece on rabies. Koch in 1882 described the tubercle bacillus and showed its etiologic relation to all forms of tuberculosis.

These were the experimental beginnings of our great basic sciences of anatomy, physiology, biochemistry, pathology and bacteriology. On these foundations, through the painstaking experimentation of scores of patient scientists, enduring structures have been built. Such a foundation is needed in physical medicine.

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* Presidential Address Delivered at the Twenty-first Annual Session of the American Congress of Physical Therapy, Pittsburgh, Pa., September 9, 1942.

What is necessary to place physical medicine on a footing comparable to that of the other medical sciences? One important factor is time; physical medicine is one of th youngest. But time alone may be a detriment unless it is used as an instrument of advancement instead of idleness and regression.

Research in Physical Medicine

Fundamental research into the physiologic effects of the physical agents is one of the most important factors in establishing physical medicine as a permanent member of the family of medical sciences. If it is to gain and maintain such a place among these sciences, in fact if it is to merit the name of a science, its physiologic effects must be conclusively demonstrated in the experimental laboratory. This does not mean that all these effects must be proved in laboratory animals; some will be, but for certain well known physiologic reasons, many of them are best shown in the human subject. What is more convincing and educational to medical students than to feel and measure physiologic changes produced in their own bodies by physical agents? Students may not only serve as subjects, but may assist in research projects; certainly, there is no better way of arousing their interest. The place for such research activity is in the department of pharmacology and therapeutics or in the department of physiology in the medical school. Fortunately, some very good physiologic research studies have been done, although time and space do not permit their enumeration. There are still numerous problems in every branch of physical medicine which challenge investigation.

The final test of any therapeutic agent is its clinical use on the sick patient. Since there are many factors in clinical research which are difficult to control, it is necessary to treat large series of patients before definite conclusions can be drawn. It is always desirable to control clinical investigations by parallel series of cases either untreated or treated by some known standard method. Lack of adequate controls is the most frequent fault of clinical studies. Careful records are essential and it is frequently advisable to provide special blanks so that the exact data desired may not be overlooked. The last essential in clinical research is adequate follow up studies in order to ascertain if therapeutic results are enduring. Clinical research in physical medicine can be carried out in the hospitals and clinics of the medical school or in the physician's office. Cooperative investigations carried on by the department of physical medicine with some other clinical department accomplish a two-fold purpose, not only acquiring the data desired, but also arousing the interest of the cooperating departmental staff.

At last year's meeting of the Congress, William T. Sanger proposed the establishment of "an institute of physical therapy of such proportions and quality as to make a convincing demonstration in this field, so adequate and challenging that its influence will be felt even abroad." That such a center would fill a great need in the advancement of physical medicine, none can doubt. Experimental and clinical research, graduate and undergraduate study would all flourish in such an atmosphere. The increasing interest of students and physicians in this field is promising for the success of such an enterprise. Let us hope, when conditions permit, that such an institute may be established.

Undergraduate Education

The future of physical medicine will be profoundly influenced by undergraduate teaching in the medical schools. The medical student of today is the physician of tomorrow. If he is impressed by a conservative scientific presentation including physiologic effects, indications and contraindications,

he will incorporate physical measures into his therapeutic armamentarium. It is the speaker's conviction that a short experimental course should be given in the sophomore year to be followed in the senior year by clinical teaching in the outpatient department and the hospital. This method, employed in the teaching of pharmacology and drug therapy, seems logical also for physical medicine. Most of the instruction given in the medical schools at the present time is clinical.

The impression which the physical medicine of the future will make on the physician and the benefit derived by the patient will be modified in large measure by the skill with which it is applied. This demands well trained technicians. The curriculum formulated by the Council on Medical Education and Hospitals provides for adequate training if it is faithfully followed. The nineteen approved schools in the United States are not training technicians fast enough to supply the demand, in spite of the fact that the well trained registered technician is not known and appreciated as she should be. Unfortunately, there are many persons attempting to do the technician's work who are not qualified. Such persons bring physical medicine into unjust disrepute. Legislation to prevent the administration of physical measures by unqualified persons has already been passed in some states and is under consideration in others.

Quailfying Medical Boards

Recognition of physical medicine by national and state boards of medical examiners and the inclusion of questions in their qualifying examinations would serve as a stimulus alike to medical schools and medical students. In all probability this will be gradually developed in the future.

The War

The impetus given to physical medicine by the first world war leaves no doubt that the present conflict also will promote its clinical use. Due to the advancement made during the past two decades, results of physical therapeutic care will undoubtedly be better than in World War I. Methods of administration may be improved. There will be an opportunity for extensive clinical investigation of the use of physical measures in the treatment of war wounds. Scientific advancement will depend on the interest and alertness of the physical medicine personnel.

The Specialties

A trend in physical medicine today, which will undoubtedly progress further in the future, is the invasion of the specialties. For many years physical medicine has been the handmaiden of orthopedics, but now we see its increasing use in neurology and psychiatry, in dermatology, in internal medicine, in pediatrics, in urology, in surgery, in otolaryngology and even in ophthalmology. As the knowledge of the underlying physiologic effects of the physical agents becomes more widely disseminated, we may expect to see their use in the medical and surgical specialties expand still more.

Tribute

This discussion would be incomplete without an acknowledgment of the important part played by the Council on Physical Therapy and the Council on Medical Education and Hospitals of the American Medical Association in the advancement of physical medicine in the United States. Through their constant emphasis on high standards, improvements in practice and education in this field will certainly continue. The American Con-

gress of Physical Therapy will, as in the past, carry on a program of education to promote the scientific use of physical medicine by the American medical profession.

Summary

There is no cause for pessimism concerning the future of physical medicine. Based on sound scientifically demonstrated physiologic principles, confirmed by careful clinical investigation, it will continue to advance. In the near future it will assume, as it is already assuming, a place in the armamentarium of the medical profession of equal importance with other methods of treatment. When the physician makes up his patient's treatment program, he will routinely consider physical medicine on the same basis that he does diet, drugs and surgery. Physical medicine will endure as a member of the established medical sciences if we continue its development and application on conservative sound scientific principles.

In the technicians' field, the American Registry of Physical Therapy Technicians and the American Physiotherapy Association may be confidently expected in the future to maintain the same high ethical and professional standards which have always characterized them.

RECENT STUDIES ON THE PHYSIOLOGY OF SPEECH PRODUCTION *

O. LEONARD HUDDLESTON, M.D., Ph.D.

Assistant Professor of Physiology and Pharmacology, University of Colorado School of Medicine; Director of the Department of Physical Therapy, Colorado General Hospital, Denver, Colorado

and

ADALINE BULLEN, M.A.

Instructor of Speech Science, Speech Pathology; Director of Speech Clinic for Normals, University of Denver

DENVER, COLORADO

In the treatment of numerous pathologic conditions physical therapy physicians and technicians are called on to develop or to reestablish proper coordination of neuromuscular activities in different parts of the body. It happens not infrequently that they are asked to treat some functional abnormality of the muscular system of the phonatory apparatus. Human speech is made possible by the proper integration of a series of highly complex neuromuscular actions extending from the head to the pelvis. For one to treat adequately some abnormality of a mechanism so complex as speech, it is necessary for him to understand the underlying fundamental principles by which speech is produced. The present communication will be divided into two parts: (1) A résumé of the principles of speech production and (2) a preliminary report on some recent studies which we have been making during the past two years on the physiology of speech production.

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The Principles of Speech Production

In the consideration of speech, it is necessary to take into account some of the physical principles of sound together with some of the anatomic structures and physiologic mechanisms by which the sounds are produced. From the standpoint of physics, sound in general may be divided into two categories, simple and complex. The simple sounds refer to "pure" tones (represented graphically by a sine wave curve), such as that produced by a vibrating tuning fork. Complex sounds are multiple vibrations superimposed on one another. These may be divided into two groups: (1) the periodical or musical tones, produced by harmonics superimposed on the fundamental in a direct mathematical ratio, and (2) the aperiodic sounds or noises in which there is no exact mathematical relationship between the various sound frequencies. Aside from the different kinds of sound, it is necessary to consider the phenomenon of resonance and its relationship to reinforcement, damping, absorption and the production of sound. In general, resonators with rigid walls give rise to sharp reinforcement of sounds, whereas those possessing soft elastic walls produce zones of reinforcement combined with damping and absorption of vibrations. The resonators of the speech apparatus of human beings are composed almost entirely of the latter type. The vibration of air contained in a cavity gives rise to the formation of sounds, the frequencies of which are determined by the volume of the cavity and the length and size of the orifice through which the sound waves pass. When some of these principles are applied to speech, it is found that the vowels, a, e, i, o and u, are musical tones, each having at least two essential and characteristic zones of frequencies, which are reinforced by the anatomic resonators. The voiced consonants, ranging from the semiconsonants (semivowels), w and sometimes y, l and r, and the voiced continuants, v, z and th, to the voiced plosives, b, d, and g, possess a varying number of harmonics and inharmonics. Voiceless speech sounds, including the whispered vowels, the voiceless continuants, f, s, sh, and th, and the voiceless plosives, p, t, and k, are complex sounds which must be classified as noises.

The important anatomic structures to be considered in speech production are the abdominal and thoracic muscles, the diaphragm, the muscles of the neck and head, the respiratory tree, including the lungs, bronchi, trachea, larynx and upper air passages, and, lastly, the various cavities which serve as resonators. With regard to the last, the larynx is said to act as a resonator, and the cavities located below it are considered as a group of more or less fixed resonators. However, the air chambers situated above the larynx constitute the most important group. These may be divided into fixed and adjustable resonators, the first term referring to fixed cavities and the latter to adjustable ones, the pharyngeal, buccal and nasal cavities.

From the point of view of the physical therapy physicians, the most important aspect of this subject is that which deals with the physiologic basis of sound production. The principal kinetic energy necessary for speech is supplied chiefly by respiratory movements. The integrated action of the abdominal muscles, diaphragm and thoracic muscles supplies the driving force for the expulsion of air through the sound-producing structures located in the laryngeal and supraglottic regions. An important feature, therefore, in the correction of any speech defect is to instruct the subject in the proper use of his respiratory apparatus. Instruction in breathing exercises in the supine and in the standing position combined with postural training will aid materially in the correction of defects involving the use of the respiratory muscles. If one desires to make a detailed study of the functional activity

of the respiratory mechanism, it may be accomplished by the use of recording pneumographs and spirometers. These are most useful when employed in combination with other speech analysis equipment.

Other mechanisms of sound production involve the functions of the larynx and the supraglottic structures. Human speech reduced to its simplest form may be regarded as a series of voiced sounds interspersed with voiceless breath sounds. The sounds are produced by air flowing through varying degrees of obstruction at different places along the air passage. The degree of obstruction may vary from only a slight narrowing to a complete closure. The resultant types of speech sounds are determined by the size, shape, consistency and location of the orifice through which the air passes. The usual sites of obstruction are the larynx, pharynx, buccal cavity, teeth and lips. The size and shape of the laryngeal aperture is the first determining factor for the production of different speech sounds. The control of the glottic aperture is provided largely by the intrinsic muscles of the larynx. The regulation of the size of the orifice, therefore, determines the amount of resistance offered to the flow of air through the laryngeal airway. Furthermore, the variable orifice is equipped with elastic structures (the vocal cords) which may be set into vibration. For the production of vocalized sounds (vowels and voiced consonants), the larynx, therefore, serves as the vibrator of the speech apparatus. The frequencies of the laryngeal sound are determined principally by the tension of the vocal cords. When these structures are set into vibration, they do not oscillate in the vertical plane, as in the vibration of a reed instrument, but rather in the horizontal plane. The neuromuscular control of the laryngeal orifice and the functional activity of the vocal cords may be inspected during different types of laryngeal activity by means of the laryngoscope. Additional information regarding the activity of the vocal cords may be obtained by the use of stroboscopic appliances.

Resonation of the laryngeal vibrations is accomplished by the activity of the muscles that form the pharyngeal, buccal and nasal cavities. The neuromuscular mechanism which regulates the size and shape of these three resonating cavities provides a system of adjustable resonators which are employed to formulate the specific characteristics of voiced and voiceless sounds. Since it is the adjustable resonators that are chiefly involved (the proportion is estimated at 95 per cent) in the selective reinforcement of the various harmonics and in the production of the aperiodic vibrations which determine the quality of the sound, a knowledge of the position of the lips, tongue, cheek and jaws is necessary in order to insure the formation of the correct kind of resonators (Parmenter and Bevans[1]).

The control of the laryngeal and supraglottic structures is effected by the muscles of the neck and head. These muscles control the position and mobility of the larynx as well as the position and movement of the pharyngeal wall, soft palate, jaws, tongue, cheeks and lips. For the proper control of the air flow through the laryngeal and supraglottic structures, it is necessary for the neurologic pattern to be coordinated in such a way that the muscles develop the correct amount of tension in an orderly sequence, so that the various orifices and resonators are formed properly.

The valve action of the soft palate controls the use of the nasal cavity as a resonator for the production of nasal tones. The accurate articulation of consonants is determined by the extent of approximation or the firmness of contact between the two lips, between the lips and teeth and between the tip, blade or dorsum of the tongue and various points along the roof of the mouth extending from the teeth to the velum. The precise action of the

muscles of the velum, lips and tongue, therefore, is extremely important in accomplishing satisfactory articulation.

Practical application of some of these principles may be made in the treatment of speech defects. Since many persons with faulty speech exhibit erroneous breathing movements combined with excessive laryngeal tension, exercises should be directed toward the correction of these defects. We have referred previously to the use of breathing exercises to provide for the necessary "diaphragmatic support." Other exercises involving the principles of relaxed movement and correct muscular coordination may be used to overcome the hypertonus of the laryngeal muscles. Exercises of this kind should be directed toward the production of good basic tone qualities. To these

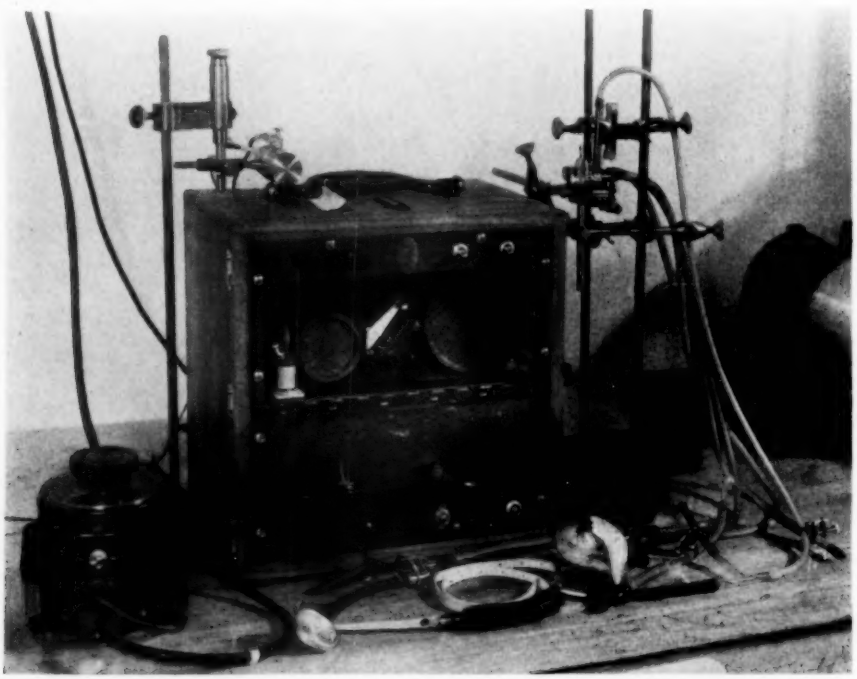

Fig. 1. — Optical recording system for the graphic analysis of speech: *A*, photokymograph; *B*, source of light (rheostat and 6 volt bulb with single straight filament mounted vertically); *C*, multiple Frank segment capsules; *D*, mouthpiece; *E*, nasal olive; *F*, laryngeal tambour; *G*, pneumograph.

may be added active exercises involving the use of speech sounds, words and phrases in order to develop coordinated contractions and relaxations of the muscles of the articultory organs. In treating subjects for the correction of speech defects such as cleft palate, spastic paralysis or even minor abnormalities such as poor enunciation and paretic or harsh voice, a therapeutic program consisting of specific corrective exercises designed to develop the coordinated use of the muscles of respiration, phonation and articulation is the treatment of choice. For a stutterer, coordinating exercises must be combined with a psychologic treatment. If the defect is aphasic in nature, a psychologic approach is indicated.

Recent Studies on the Physiology and Speech Production

Laboratory apparatus has been devised for the study of some of the physiologic mechanisms involved in speech production. The equipment has been set up as a graphic recording method. The so-called graphic method

enables one to follow the moment by moment sequence of events that takes place in the phonatory organs during speech. The first method we employed in our investigations was that of a mechanical recording system similar to that developed during the nineteenth century by Rousselot[2] and later improved by Scripture[3] and by Grammont.[4] The apparatus consisted of suitable sound and pressure receivers, such as the mouthpiece, nasal olive, laryngeal tambour and pneumograph. The recording tambors were of small size, measuring 1 cm. in diameter. Each possessed a short light stylus (broom straw or balsam wood) to which was affixed a fine foil writing point. Time measurements were provided by a 100 cycle electric tuning fork. The sound tracings and pressure displacements were recorded on the smoked paper of a rapidly revolving drum of an electrically driven kymograph. This method enables one to secure fairly satisfactory records if one has sufficient time to operate recording equipment of this type (that is, prepare and fix the smoked paper, make the necessary repairs of the tambours and adjust the recording system so that useful records can be obtained). Our experience with this method soon convinced us of the necessity of developing apparatus more suitable for this type of investigative work. The technical problem was solved by substituting an optical recording system (fig. 1). Essentially the same receiving instruments were used as in the other method. Multiple recording Frank capsules were substituted for the recording tambours, and the kymograph was replaced by a photokymograph (Dayton double channel oscillograph). A light source and a system of lenses and mirrors associated with this equipment enabled us to record tracings simultaneously from the mouth, nose, larynx, chest and abdomen.

When this equipment is used for speech analysis, the buccal tracing records the vibrations that are transmitted from the buccal cavity to the mouthpiece and also the pressure changes caused by the movement of the lips and tongue and by the escape of air from the mouth. The nasal tracing records the vibrations which are transmitted through the nasal cavity. This enables one to determine, at any time during speech, the functional activity of the soft palate as regards that state of opening or closure of the nasopharynx. The laryngeal tracing registers the movement of the larynx and displays the pressure changes which are transmitted from the larynx through the cervical structures to the laryngeal receiving tambour. The pneumographic tracing shows the motor activity of the respiratory mechanism during speech. It enables one to determine with accuracy the degree of "diaphragmatic support." Figure 2 shows typical examples of speech records obtained by the use of the optical recording method. The test phrase used by both subjects was "two kymograph tracings and a diagram." In figure 2*A* is represented an example of multiple tracings obtained from a subject possessing a speaking voice which shows accurate speech characteristics. The buccal tracing reveals precise articulation, as evidenced by well defined excursions of the implosions and explosions of the occlusives. The nasal curve shows vibrations corresponding to the nasalized consonants. However, some degree of assimilation may be seen in association with adjacent phonemes (anticipatory and prolonged vibrations preceding and following each nasal consonant). The excursions of the laryngeal curve are excellent, showing an inverse direction only twice (at *x* and *y*). These "errors" may be attributed to accents on the "t" of "tracing" and the often accented vowel "a" of "and." The nearly uniform gradient of the pneumogram during expiration reveals an accurate respiratory support. Figure 2*B* exhibits a similar speech record obtained from a subject whose speech may be described as characterized by a "whining voice with a nasal twang." The buccal line shows progressive

weakening of articulation with a resultant increase of nasality. Twelve of the excursions of the laryngeal line take the wrong direction, and the pneumographic curve reveals entire lack of support.

In order to obtain a more precise conception of the extent of accuracy of speech, a series of graphic records were made of the speech of a selected group of persons, possessing so-called normal speech. The subjects used in

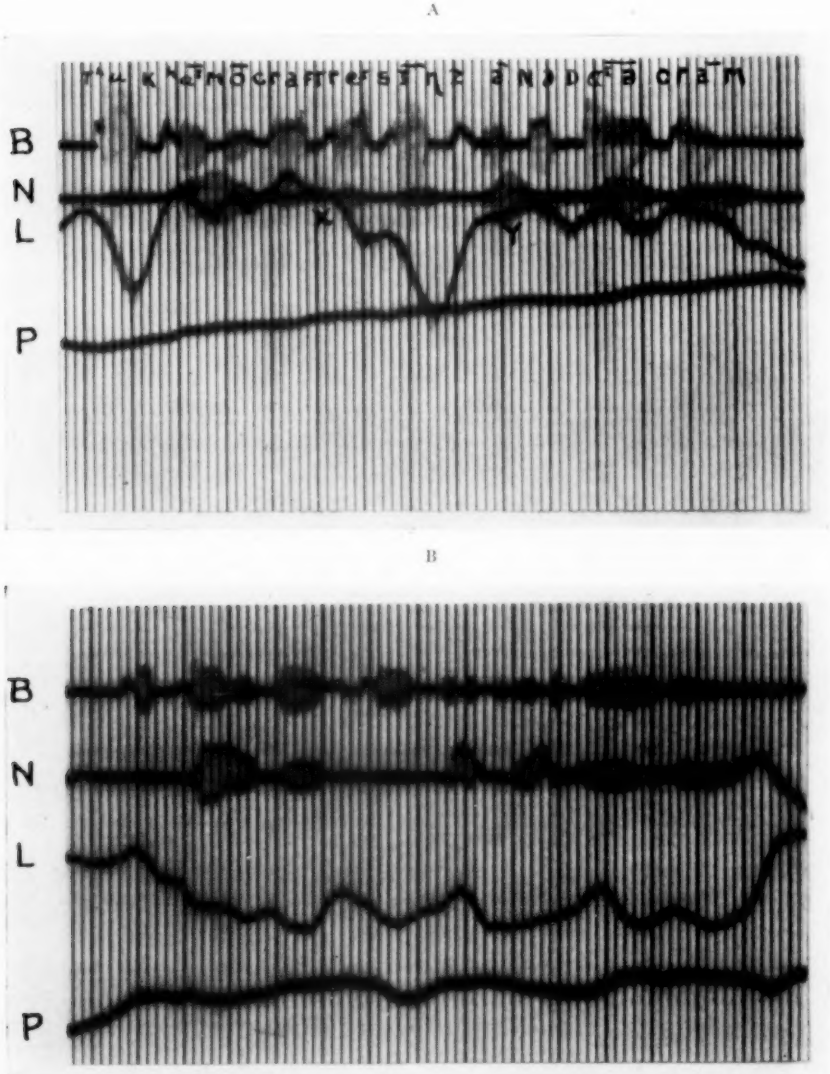

Fig. 2. — Speech records obtained by the optical method of recording: *B*, buccal tracing; *N*, nasal tracing; *L*, laryngeal tracing; *P*, pneumographic tracing. Record *A*, for subject O. L. H., shows accurate speech characteristics. Record *B*, for subject M. B. G., shows faulty speech (inaccurate articulation, hypernasality, improper laryngeal movements and inadequate diaphragmatic support).

this investigation were chosen at random from the personnel of the University of Colorado School of Medicine and of the University of Denver. The entire group was made up of college professors and advanced college students. The observations were made on 10 subjects, of whom 6 were men and 4 were women. The test phrase given each person to say was "two

kymograph tracings and a diagram." It contains twenty-eight speech sounds, of which five are voiceless consonants, twelve voiced consonants (including four nasals) and eleven vowels. From the analysis of the respective speech records of this group of subjects, we have compiled the following comments:

The amount of articulatory precision evidenced was sufficient to be classified as good for 5 of the subjects, as mediocre for 1 and as poor for 4. Five voices showed no incorrect nasality other than minor assimilation of nasal resonance. The speech of 5 subjects possessed excessive hyperrhinolalia of speech sounds ranging from 65 to 74 per cent of the total duration of the phrase. If the phrase had been spoken accurately, the correctly nasalized phonemes should have occupied only 10 to 12 per cent of the time. Four of the voices noted as good from the articulatory point of view showed no appreciable hypernasality, whereas all of those showing hypernasality showed poor articulation. Thus, we see a close correlation between poor articulation and excessive hyperrhinolalia. Four voices had good laryngeal activity, 2 were mediocre and 4 revealed extremely faulty laryngeal tensions lasting from 55 to 58 per cent of the time. The pneumograms of 5 subjects revealed adequate respiratory movement; of the remaining 5, 1 had good respiratory support but had excessive laryngeal tension; the other 4 displayed both erroneous laryngeal movements and inadequate diaphragmatic support. The speech records reveal, therefore, another general correlation, namely, that the subjects with good laryngeal tracings had good pneumograms and those possessing erroneous laryngeal movement and tension had poor diaphragmatic support. In further summary of the records, it may be said that all four curves were good in the tracings of 4 subjects, all four curves were faulty in those of 2 subjects and only one or two of the curves were good for the remaining 4 persons. We were amazed to find such a high incidence of minor speech defects in this group of native-born college graduates. The speech defects commonly encountered were excessive nasality, inaccurate articulation, incorrect movement and improper tension of the larynx and inadequate diaphragmatic support.

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CLINICAL APPLICATIONS OF OXYGEN THERAPY *

H. CORWIN HINSHAW, M.D.
Division of Medicine

and

WALTER M. BOOTHBY, M.D.
Section on Metabolic Inveatigation, Mayo Clinic

ROCHESTER, MINNESOTA

The human body may be deprived of food for weeks or even months before death occurs. It can survive without water for only a few days, but an absolutely constant, unfailing supply of oxygen is necessary, death occurring within minutes if this be interrupted. A considerable share of the metabolic activities of the body is directed toward acquiring, transporting and utilizing this essential element. The principal functions of the respiratory and circulatory systems are directed to this end and oxygen consumption is involved in most chemical activities of the organism. The central nervous system is most continuously and urgently in need of an adequate and unfailing oxygen supply, and the earliest symptoms of oxygen deprivation are due to malfunctioning of the higher brain centers. A few minutes of complete anoxia will produce irreversible changes in the central nervous system, resulting in death or permanent disturbance.

Respiratory Decompensation

Compensatory mechanisms may be called into action when the concentration of oxygen in the inspired air is lower than normal. The oxygen carrying capacity of blood is increased by development of relative polycythemia which occurs among those persons who reside continuously at high altitudes and among some patients whose oxygen intake or transport is impaired by disease of the respiratory or circulatory system. This mechanism requires many weeks for development and is of no value in more acute clinical disease, although it may be imitated by transfusion. In acute febrile illness there is an increased demand for oxygen and, if the respiratory system be diseased as in pneumonia, there is decreased efficiency of the functioning of the lungs, which acquire oxygen. In such circumstances there is an increase of the rate and depth of respiration and of cardiac rate, as well as a dilatation of peripheral vessels in the tissues. Among patients who are desperately ill, the total energy consumed in these compensatory processes may be considerable, and it is a well known fact that death is due in many infectious diseases to exhaustion of the cardiovascular system. It thus becomes obvious that the clinician must search for any therapeutic aid which will spare the circulatory and respiratory organs from this great strain.

Cyanosis and dyspnea are not necessarily early symptoms of oxygen want. These are, rather, better regarded as symptoms of "respiratory decompensation," for they occur only when compensatory mechanisms have failed. When cyanosis and dyspnea make their clinical appearance, not only should the physician supply therapeutic oxygen but he should also experience a sense of regret that he had not recognized the need for oxygen before such a state of decompensation developed. The indications for oxygen therapy are immediately widened if one views the physiologic mechanisms as just

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described, regarding this therapeutic aid as a means of avoiding a desperately serious situation, as well as a means of treating such conditions. Clinical observations will amply confirm the theoretical supportive value of oxygen therapy. To delay oxygen therapy until a state of respiratory decompensation has developed might be compared to withholding treatment for a failing heart until a state of cardiac decompensation has developed.

Primary Pneumonia

Pneumonia constitutes one of the most direct and best known indications for oxygen therapy. In recent years the use of oxygen in treatment of pneumonia has declined as a direct result of the greatly improved prognosis in this disease when modern, specific chemotherapy is employed. Despite chemotherapy, there is still a definite mortality rate in pneumonia, and we hope that this can be reduced further by routine, early and effective administration of oxygen. Any theoretical or practical analysis of the problem of this residual mortality rate will result in the conclusion that physicians are slowly losing their fear of pneumonia and may be placing too much reliance on one method of therapy rather than utilizing every weapon at their disposal. We suggest that oxygen therapy is desirable in every case of serious pneumonia so long as there is elevation of temperature, pulse rate or respiration rate. When oxygen therapy is discontinued, the pulse and respiration rates should be watched carefully and treatment should be resumed if indicated by sharp rise in temperature, cardiac rate or respiration rate. As a result of modern chemotherapy, patients suffering from pneumonia are usually receiving oxygen for three or four days instead of for one or two weeks as previously was the case.

It is not always possible to foresee which patients will not respond to chemotherapy, and it is these who should receive oxygen from the onset of their illness, especially if there be extensive pulmonary consolidation, as has been seen so frequently in cases of so-called virus pneumonia. The respiratory reserve of such patients is sometimes seriously reduced, and we have seen patients suffering from extensive "virus pneumonia" whose lives were undoubtedly saved by oxygen therapy. Should a great influenza epidemic strike our armed forces, we should be prepared to deal with large numbers of such cases of pneumonia. The early diagnosis of such atypical pneumonia may be difficult because of lack of physical signs of consolidation.

Atelectasis

Atelectatic pneumonia, such as occurs following operations or following trauma, is an especially important indication for oxygen therapy. This secondary type of pneumonia is of rapidly increasing importance in wartime because of its occurrence following injury. Atelectasis is due to inadequate ventilation of the lung, bronchial obstruction from secretions or foreign substance and finally pulmonary consolidation from retained infectious material. The direct and prompt bronchoscopic approach to this problem is unquestionably of paramount importance but is available only to a limited number of patients and is of greatest value in early stages of the disease. We may anticipate that large numbers of cases of postsurgical and post-traumatic atelectasis will appear under the difficult circumstances of military medical practice. In addition to bronchoscopic aspiration, these patients should receive inhalations of a mixture of 5 per cent carbon dioxide and 95 per cent oxygen intermittently as a stimulation to respiration and expectoration, and administration of oxygen continuously as in primary types of pneumonia.

Thoracic Operations

War injuries require a considerable number of thoracic operations. This branch of medical science has largely developed since the last great conflict and is still undergoing development. Thoracic surgeons (Harrington,[1] 1942) believe that oxygen therapy is required routinely following intrathoracic operations because of the profound physiologic disturbances produced by such procedures. An increased efficiency of oxygen exchange within the lungs and diminution of cardiovascular strain should decrease the surgical mortality rate. The use of oxygen following operations on the chest wall, as in thoracoplasty, has not become widespread, and we do not know if adequate experience with its use has been obtained to justify sound conclusions. It is our suspicion that some of the reactions which occur following thoracoplasty and other operations on tuberculous patients may be due in part to anoxia, and we should like to suggest this as a suitable topic for investigation.

Pulmonary Edema

Pulmonary edema is a very distinct clinical entity although not commonly recognized specifically. When pulmonary edema develops, fluid from the blood stream rapidly passes through the barrier of the alveolar membrane into the alveolar spaces. Fluids within the bronchial lumen disrupt the entire mechanism of exchange of oxygen and lead to rapid death by what is nothing less than drowning. The causes of pulmonary edema are not well understood, but it must be due to increased pressure within the pulmonary circulation, to changes of permeability of the membrane or to both of these causes. It is known that lack of oxygen predisposes to pulmonary edema and that administration of oxygen, if started early enough, may be beneficial or even lifesaving. The combination of oxygen with helium helps overcome the mechanical barrier produced by the fluids within the alveoli. The administration of oxygen under positive pressure in selected cases of pulmonary edema may eventually gain wider acceptance, but at present work in this field is incomplete. Pulmonary edema should be suspected when coarse râles or increasingly abundant watery expectoration develops and this group of symptoms should be considered urgent indications for oxygen therapy in its most concentrated form.

Asthma

Our associates who deal with cases of severe and intractable asthma have concluded that oxygen therapy is indispensable in their practice. Pure oxygen administered by the B. L. B. mask is usually tried first and if this is not adequate, a mixture of helium and oxygen is utilized. Dyspnea, cyanosis and exhaustion are the outstanding indications for oxygen therapy. Frequently it permits seriously exhausted patients to relax and sleep soundly for the first time in days. Those patients who no longer respond to epinephrine may sometimes dispense with the drug long enough to react normally again and thus permit resumption of conventional therapeutic methods.

Cardiac Disease

The use of oxygen in cardiac disease is gaining wider acceptance and in addition to its great symptomatic value in selected cases, it appears to be of lifesaving value. This is particularly true during the more acute phases of coronary thrombosis. It reduces restlessness, relieves pain and aids in overcoming the condition of shock which develops in these cases. Pain which morphine fails to relieve may sometimes be relieved by oxygen. The use of

oxygen in ordinary congestive heart failure produced by other causes is frequently of symptomatic value and now that simplified apparatus is available oxygen may be used in smaller hospitals and even in the home. An excellent criterion of value in such instances is the patient's comfort; if the patient is obtaining sufficient benefit to offset the slight discomfort he will offer no objection to efficient oxygen therapy. In many such conditions oxygen used intermittently is of great value and patients will often ask for it as they need it, and may be taught to operate modern simplified apparatus.

Shock

Traumatic shock and postoperative shock have become subjects of widespread and intense interest in recent months and years because of their extreme importance in military medicine. The pathologic physiology of shock is a subject much too complicated for discussion at this time. The outstanding clinical feature of shock is circulatory collapse. Since transport of oxygen is a prime function of the circulatory system, severe anoxia rapidly develops and appears to continue to propagate the disturbance in the manner of a vicious circle. If the original inciting agent has ceased to act, treatment of shock should be successful if circulating blood volume can be re-established and the condition of anoxia overcome. This has been demonstrated in postoperative shock (Boothby, Mayo and Lovelace,[2] 1940) and should apply also to treatment of traumatic shock of war injuries. At the present time oxygen therapy in shock is being used extensively in British and American military hospitals. The time may come when oxygen inhalation apparatus can be made available for use in the advanced zone.

The state of shock and exhaustion which results from prolonged exposure of sailors to cold sea water becomes an important indication for administration of oxygen in naval warfare. These men have often aspirated water and fuel oil into the tracheobronchial tree and have been exposed to low temperatures for many hours. Their revival is sometimes a matter of considerable difficulty, and the mortality rate is high.

The state of shock and severe toxemia accompanying severe burns, as sustained by aviators especially, is another wartime use for oxygen therapy now receiving considerable study and practical application.

Additional Uses

Injuries to civilians during bombing raids have resulted in extensive trauma to intrathoracic organs and in other wounds producing severe secondary shock. Oxygen therapy is being used extensively in treatment of such injuries in Great Britain.

A wide variety of infectious and metabolic diseases produce disturbances of transport and metabolism of oxygen to such an extent that oxygen therapy appears to have definite value as a supportive and symptomatic remedy. In advanced stages of hepatic cirrhosis, there is marked disturbance of oxygen metabolism which produces cyanosis and other evidences of anoxia and which calls for oxygen therapy. The same is true of such severe infections as some forms of septicemia and other overwhelming bacterial infections. The bluish discoloration produced by sulfonamide compounds employed in these diseases not only serves to mask cyanosis of anoxic origin but may contribute to the impairment of oxygen carrying capacity of the blood. In actual practice we and our associates have found it frequently desirable to employ oxygen therapy as a "therapeutic test." If it relieves symptoms, if it lowers temperature, if it decreases pulse rate, it should be continued in such instances. If, on the other hand, the patient seriously objects to the mask or

the tent and no objective or subjective benefit is demonstrated, the treatment may be discontinued.

Oxygen as a means of decompression of air-containing cavities has found considerable use, especially in surgical disease. The physical principles involved in this form of therapy are relatively simple. The principal gas present, in a distended bowel, for example, is nitrogen. If no further nitrogen is inspired in the air, the patient breathing pure oxygen, the equilibrium between the gaseous contents of the bowel and the blood will be disturbed in such a manner that nitrogen is abstracted from the distended loop of bowel and excreted by exhalation through the lung. For this to become effective, it is essential that only pure oxygen be employed and this can be accomplished only by uninterrupted use of an efficient mask. The use of an oxygen tent, nasal catheter or leaky mask will not accomplish the desired aim. The patient must be warned not to swallow air.

No consideration of oxygen is complete without at least a brief mention of its use in aviation, although the subject is outside the limitations of a clinical discussion. It has been necessary to devise inhalation apparatus which will function at wide variations of altitude under widely varying conditions of temperature and yet which will be economical but continuously adequate under varying conditions of activity of various members of the aircraft crew. Parachute escape at high altitudes also calls for equipment to supply oxygen to the subject while undergoing the effort of escaping from the plane and while he is falling through the upper zones of rarefied atmosphere (Boothby, Lovelace and Burchell,[3] 1941). Should a flier open his parachute at an altitude of 30,000 to 35,000 feet (9 to 11 kilometers), he would need to be supplied with oxygen for ten minutes before reaching air of sufficient density to enable him to breathe with safety.

Oxygen therapy may yet find extremely important uses during this war in treatment of soldiers and civilians who have been injured by war gases. Those gases which produce pulmonary edema (phosgene, Lewisite, and so forth) may lead to rapid death by profound disturbance of oxygen absorption by the lungs. The efficient use of oxygen could be lifesaving in many such cases.

The development of simplified, comfortable and effective oxygen masks has done much to increase the use of oxygen therapy among general practitioners in smaller hospitals, and even in the patient's home. It is possible to administer pure oxygen by this method with minimal waste, a flow of 6 liters per minute being adequate.

Recently new apparatus has been developed in conjunction with the Chemical Warfare Service which permits great saving of the amount of oxygen consumed. This apparatus is of the closed circuit type with absorption of carbon dioxide and water vapor by shell natron. After flushing out the apparatus with oxygen a constant stream of oxygen is fed into the apparatus at the rate of 1 liter per minute. This is two to three times the amount actually used by the patient. The excess of oxygen therefore will produce an "outboard" leak instead of an "inboard" leak in the event that the mask is not absolutely airtight. This type of administration requires only a sixth as much oxygen as the conventional continuous flow type, 1 liter per minute being fully adequate under most circumstances. The extreme importance of this economy cannot be overemphasized in wartime. If oxygen is to be employed extensively in military practice, this development should greatly reduce the energy and materials required for manufacture, transportation and storage of this valuable therapeutic aid.

The oxygen tent still has an important place to fill. It is indicated under

conditions in which air cooling is important if the patient does not suffer from a sense of claustrophobia. It should be used only when proper supervision can be maintained and at best the concentration of oxygen cannot be maintained at more than 50 to 60 per cent. In military hospitals especially it seems probable that the use of an efficient type of oxygen mask should and will largely supplant the oxygen tent. The tent is too cumbersome and requires a continuous supply of ice and a certain amount of servicing because of its somewhat complicated mechanical structure. The tent utilizes much more oxygen than the mask, is more expensive to purchase and requires strategic materials in its manufacture which may be difficult or impossible to secure.

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(For Discussion, See Page 608)

RESUSCITATION *

FRANK SAYLOR ROSSITER, M.D.

Lecturer in Industrial Hygiene, University of Pittsburgh, School of Medicine

PITTSBURGH, PA.

Resuscitation is bringing back to life, one who is apparently dead. To do this, artificial respiration must be resorted to, since in all such cases, the victim has stopped breathing or the breathing is very poor. Artificial respiration is precisely what the name implies. It makes the patient breathe artificially, until nature establishes normal respiration. There are many causes of cessation of respiration, the most frequent being electrocution, carbon monoxide and other gases, drowning, ingestion of certain drugs, injuries to head or abdomen, and various diseases of the nervous system.

Before artificial respiration is discussed, a few remarks should be made concerning normal breathing. The purpose of breathing is to take air into the lungs which contains about 20 per cent oxygen. This oxygen is absorbed by the blood in the fine capillaries in the lung tissue and carried to every part of the body by the circulation. Oxygen is essential for the life of all tissues, and when a tissue's oxygen supply has been stopped or diminished, the cells undergo a change, resulting in a degeneration. Nature has provided a reserve supply of practically everything the body needs, to be used in cases of emergency such as water, fats, salts and sugar, and there are enough of these substances stored up in the tissues to last many days, with the exception of oxygen. The only reserve supply of oxygen is that in the blood and the small amount in the air in the lungs, which, it has been estimated, is barely enough to sustain life for ten min-

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utes. After this period, certain cells of the body, particularly the brain cells which cannot stand oxygen lack as well as other cells, degenerate and die. This oxygen-want in the tissues is known as anoxia. In most cases if the anoxia has not been too severe, and has not lasted over an extended period, only an irritation of the cells without degeneration is created. If respiration is established quickly, the irritation will clear up without degeneration or necrosis of the cells but once a degeneration has been set up, it may become progressively worse ending in permanent damage or death. Once a brain cell has degenerated it is never regenerated.

A valuable adjunct to artificial respiration is pure oxygen given with the proper kind of a mask. Oxygen, when available should always be given as much better results are obtained. Since the blood derives its entire oxygen supply from the lungs, the importance of giving artificial respiration before ten minutes have elapsed can readily be seen. Carbon dioxide in the blood is the normal stimulus to the respiratory center and if 5 to 7 per cent is added to the pure oxygen given in conjunction with the artificial respiration, the rate and depth of respiration will be greatly increased.

In carbon monoxide poisoning there is paralysis of the respiratory center, because the anoxia created in the medulla causes a cessation of respiration, but the heart may continue to beat for sometime. In electrocution the heart stops first and the breathing may continue for sometime. It is obvious that immediate and efficient first aid treatment is an important factor in cases of gas poisoning. Of the patients with severe gas poisoning whom I have attended, all of whom were unconscious, and in many of whom the breathing had stopped and there was no sign of life all recovered and none had any serious after-effects. I attribute this to prompt and efficient first aid treatment.

Artificial respiration may be given by two methods; the manual and the mechanical. Each has its advantages and disadvantages. The manual method has the advantage that no apparatus is required. It is easily taught, but is tiresome and the amount of good done, depends a great deal on the skill of the operator. These points will be discussed later on.

The history of artificial respiration dates back to the Bible, where mention is made of lives being saved by mouth-to-mouth insufflation. This is still one of the best, as the exhaled breath of the operator blown into the lungs of the victim, contains about 5 per cent carbon dioxide, the normal stimulus to respiration. It is frequently used with excellent results on the new-born baby but it may do harm, however, if too much pressure is used.

The modern history of artificial respiration began about 1775 when the Dutch Humane Society advocated mouth to mouth insufflation in cases of drowning. Later on, Hall and Howard resorted to rolling the victim on a barrel or rolling him from the supine to the prone position. In 1858, Sylvester brought out another method which is known by that name.

In the Sylvester method, the victim is placed on his back with his arms folded over the lower part of his chest. The operator stands at the head of the patient facing his feet. He then reaches down, grasping both wrists and pulls the arms up in a semicircle until the hands reach the floor. This increases the size of the chest cavity, and the air rushes into the lungs. The arms are then moved back to the original position, and folded over the chest and pressure is exerted on the lower part of the chest the patient still being held by the wrists. The second movement forces the air out of the lungs. These movements are alternated at about the rate of 15 times a minute.

This method was in use until about 1903 when it give way to the Schafer Prone Pressure method of today. The Sylvester method is tiresome to the operator; the supine position does not promote the clearing of the throat of

mucus, vomitus, etc., which may greatly impede resuscitation; it cannot be used in fracture of arms, ribs or the shoulder girdle but it has been successful in many cases.

In 1903, Edward A. Schafer gave his first account of the prone pressure method. This method gives a greater exchange of air in the lungs, promotes evacuation of foreign material and mucus from the throat, and makes the tongue fall forward, due to gravity, instead of backward, where it might occlude the respiratory tract. The following table is given showing the amount of air exchange: normal respiration, 450 cc.; Sylvester method 175 cc.; Schafer method 520 cc. Of course in any method the amount of exchange depends on the skill of the operator.

The following is a brief description of the Schafer method: —

Place the victim on his abdomen, one arm extended directly over the head, the other arm bent at the elbow and the face turned outward, resting on the forearm, so that the mouth and nose are free for breathing.

Kneel astride the patient's thighs, placing the palms of both hands on the small of the back with the fingers resting on the ribs, the little finger touching the lower rib and the tips of the fingers just out of sight.

Lean forward slowly so that the body weight is brought gradually to bear on the chest, keeping the arms absolutely straight without bending the elbows. This forces the air out of the chest.

Swing back ot the original sitting position, removing the pressure completely. The elasticity of the chest walls causes the chest to return to its normal shape, again and air is sucked into the lungs.

For the best results, regardless of the method used, there must be some rhythm to the operation. It should not be too fast or too slow. A good plan is to teach the operator to say, as he applies pressure, "Out goes the gas," and then as he comes back to the original position, "In comes the air." This consumes about four seconds which would be about the normal number of respirations per minute.

Artificial respiration should be started immediately and continued without interruption until normal breathing has been established, three hours or longer, or until the victim is pronounced dead by a physician. After the artificial respiration is discontinued, the breathing should be carefully watched, because it often happens that the breathing stops again or becomes poor, necessitating continuation of the artificial respiration.

As has already been mentioned, artificial respiration should be started immediately on discovery of the victim, and at the site of the accident, but if it is necessary to move the patient there should be no interruption in the treatment. Time is of paramount importance in the management of asphyxia. It is comparatively easy to cope with slight asphyxia, whereas it is difficult, if not impossible, to resuscitate after the heart has ceased to beat. The longer the period after the victim has stopped breathing, the more difficult it becomes to start his breathing again and the longer artificial respiration will be required before he is revived.

In recent studies of cases of electric shock by the Harvard Medical School, it was indicated that about 70 per cent of the patients recover if artificial respiration was started within three minutes. The recovery rate drops to 58 per cent if artificial respiration is not started for four minutes. This research brought out the fact that continued artificial respiration for an extended period is necessary, and no person should be pronounced dead until twelve hours of artificial respiration have been tried or until rigor mortis sets in.

Other points to be remembered are: Loosen tight clothing about the neck, chest and waist; see that all foreign material such as tobacco, false teeth, gum and food are removed from the mouth and throat; keep victim warm with blankets and external heat; massage the muscles to stimulate the circulation;

give no liquids by mouth while in an unconscious state; keep his head down and treat him for shock; do not forcibly restrain patient as to do so causes undue exertion on his part; the use of respiratory and heart stimulants seems to do little good; venesection, blood transfusions or injections of oxygenated saline solutions are not only valueless but may prove harmful. After the victim has been revived he should be put to bed with absolute rest and have him avoid all exertion because his heart has been weakened by the anoxia. The after treatment consists of careful nursing and symptomatic treatment.

Several other comments on the Schafer method should be made at this point. Sudden snapping back of the hands appears dramatic but serves no useful purpose; it is erroneous to think that if the victim is breathing at all, no artificial respiration should be given as it might not be in rhythm with his normal breathing; whether or not the hands should be removed from the chest after pressure has been applied is a question for argument. To remove them is more restful for the operator, but there is no difference in the results obtained, if the operator works with mechanical smoothness and with no abrupt motion at any time. Old people and young children should be handled carefully, injuries such as broken ribs or internal injury may be caused. In cases of pregnancy and where there has been a recent abdominal operation, the Sylvester method should be used, as well as in all cases in which there are broken ribs or vertebrae and bad burns of the chest. The reason here is obvious.

Regardless of what method is used, it is always advisable to administer oxygen in connection with artificial respiration when it is available. I know of no condition in which it is not indicated. There are numerous ways of administering oxygen, but the most efficient is with an apparatus having a tightly fitting mask and a large breathing bag. The most satisfactory machines today are the inhalation devices on the E and J Resuscitator and the Pulmotor, the Atmos inhalator and the H and H inhalator. Of course there are many others which give good results. Another method is by the intranasal catheter but this is hardly applicable in first aid work. The funnel and wash bottle method is of little value because the oxygen is too diluted on reaching the nostrils.

There has always been a controversy over the merits of the manual and the mechanical means of artificial respiration, in fact all mechanical means have been condemned by various commissions until recently when the E and J resuscitator was accepted by the Council on Physical Therapy of the American Medical Association. Fault has been found with the mechanical method mostly by men who have never had any practical experience with it and, who, on theory alone, say that it may do harm to the lung tissue; that there may be a tendency to wait for the arrival of some mechanical means instead of performing artificial respiration immediately; that the patient may offer a resistance to the use of a machine causing rapid alteration from pressure to suction; that the apparatus may be out of rhythm with the victim's normal breathing; that the rhythm may be too fast or too slow; that the oxygen might go into the stomach instead of the lungs; that there is danger of forcing infected material into the lungs, causing irritation and possibly pneumonia; that all machines require trained men to use them; and that they are liable to get out of order and not work.

In answer to these statements, I might say that the mechanical method is used only in cases in which the breathing has stopped or is very poor; the victim is unconscious and offers no resistance to the pressure and suction. It is impossible to use either the E and J resuscitator or the pulmotor on a conscious person owing to the resistance offered but when a victim is conscious or semiconscious and breathing of his own accord, there is no necessity for using the resuscitator and the machine can be shifted over to the inhaling device found on most of these machines. As to the rhythm being too fast or too slow, the

pulmotor is set to operate about 15 times per minute while on the E and J resuscitator there is a means of regulating the alterations to any desired number. The statement that these machines may cause lung injury is unfounded. Over a period of thirty-three years during which time I have had the opportunity to use the mechanical method hundreds of times, there has never been any ill effects produced. Other physicians, to whom I have talked, who have had considerable experience with the mechanical method agree on this point. As to the criticism that valuable time might be lost awaiting the arrival of some apparatus, it does not appear likely that anyone would stand around doing nothing, particularly at this late date after so much has been said about first aid. I have never known of the oxygen going into the stomach but this could be avoided by pressure over this organ. There is always the possibility of any machine getting out of order but I have never had any trouble along these lines, possibly owing to our periodic inspection. As to the apparatus forcing infected material into the lungs, I believe this is of little importance. It must be remembered that we are trying to save the life of one who is on the verge of death and that we must resort to heroic means.

In a recent article Birnbaum, Thompson and Ostrow[1] stated that rhythmic inflation and suction was by far the most efficient method of resuscitation in their experiments; the suction and pressure method within safe limits of suction and pressure rests on sound physiologic principles; it does not depend on the tonus of the respiratory muscles as in the manual method of expiration. Out of rhythm with the machine indicates a return of spontaneous breathing and time to desist from the use of mechanical means. The mechanical method gives a distinctly greater pulmonary ventilation and is far superior to the manual method when respiration has stopped. — (*J. A. M. A.*, April 18, 1942.)

Of the various machines used in the mechanical method of artificial respiration the only ones worthy of note are the Ericson and Johnson (E & J) resuscitator or equivalent, the pulmotor and the Drinker iron lung. The resuscitator and pulmotor act in practically the same manner causing an interchange of air in the lungs by suction and pressure. There is a far greater exchange than in any of the manual methods, the resuscitator giving pure oxygen and the pulmotor about 47 per cent oxygen in air. The amount of suction and pressure is within the limits of safety. Resuscitator, 3 oz. pressure and 2 oz. suction; the pulmotor, 4.6 oz. pressure and 5.9 oz. suction. These machines are entirely automatic and do not depend on the skill of the operator; they ventilate the lungs by pressure and suction regardless of the amount of carbon dioxide in the blood: they require only one operator; there is no manual labor and they can be used in cases in which the manual method would be harmful, as when there are fractured ribs, vertebrae or shoulder girtle, burns of the chest, or internal injuries, when the patient is pregnant and after recent abdominal operations.

The Drinker iron lung or respirator, is a cylindrical air-tight chamber, large enough to encase the whole body, with the exception of the head, which protrudes through a soft rubber collar. By means of a motor, the air is exhausted from the chamber creating a partial vacuum, and causing the chest to expand and the air from the outside to be drawn into the lungs. When a certain point is reached, the vacuum is automatically released and the elasticity of the chest walls causes expiration. Patients have been kept alive for months and even years in these machines, but, being cumbersome and expensive, they are not suitable for first aid work.

In conclusion, I should like to again emphasize the importance of prompt and efficient first aid treatment by means of the Schafer prone pressure method of artificial respiration, in conjunction with inhalations of pure oxygen when available, and the use of the mechanical method if the patient has stopped

breathing, providing the apparatus is at hand but without waiting for its arrival.

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Discussion of Papers by Drs. H. Corwin Hinshaw, Walter Meredith Boothby and Frank S. Rossiter

Dr. G. J. Thomas (Pittsburgh, Pa.): I agree with Dr. Hinshaw that oxygen is a valuable adjunct in therapeutics. We must consider that the basis of energy is oxidation. It is through oxidation that the electrical potential of cells is built up and maintained; therefore, it is through oxidation that normal activities of all organs and tissues of the body are maintained. Oxygen increases the electronegative and positive valance part of a cell. In depression and shock there is a failure of the actual oxidation in body, that is, a failure of the internal respiration of the body corresponding to the degree of depression and shock.

When in the course of a surgical operation the patient is depressed by surgical shock, hemorrhage, infection, or by crisis of hyperthyroidism, it means that countless millions of organic molecules have broken down and that these can be restored and repaired only by rest, sleep and normal oxidation.

Not only does this general plan of maintaining a high level of resistance of the patient prevent the breakdown of the myocardium, kidneys, liver, pancreas and the brain, but it sets up the best type of defense against infection, pneumonia and wound infection. In other words, we have set up a formula for raising and maintaining the vitality of the patient before, during and after the operation; and one of the essential factors in this formula is the oxygen therapy.

I personally feel that oxygen should be used in all conditions in which there are increased pulse and respiratory rates in order to conserve the needed heart energy. This brings me up to a simple method that should be used in prescribing oxygen. The common method used in hospitals is one in which the physician orders certain liters of oxygen for a patient. Frequently the amount is insufficient or is a waste. The nurse cannot use her initiative in changing the amount. I feel that better results are obtained when we write for oxygen as follows—"Oxygen q. s. to reduce pulse and respiratory rates and improve color."

The nurse can be trained to use good judgment and not waste the oxygen but give the patient enough to improve his condition.

Dr. Rossiter covered thoroughly the subject of resuscitation. I wish to add that for one to understand the mechanism of resuscitation, one must understand the Hering-Breuer reflex, in order to effectively employ the various methods of resuscitation to an unfortunate victim.

There are several points that Dr. Rossiter mentioned in his paper that I would like to reemphasize: 1, start resuscitation without delay, every second is valuable; 2, loosen the clothing, especially around the neck; 3, remove all foreign particles from the mouth; 4, keep the patient warm; 5, massage muscles in order to stimulate the circulation; 6, do not give up too soon.

THE INFLUENCE OF INTERNAL FIXATION ON EARLY MOTION OF FRACTURED LIMBS *

GEORGE V. FOSTER, M.D., F.A.C.S.

PITTSBURGH, PA.

Not so many years ago the only thought in the treatment of fractures was that a firm bony union should be obtained, and since this was most easily and most surely accomplished by prolonged fixation of the fracture and the joints above and below the fracture in a plaster cast, this was carried out with the ultimate in thoroughness. If the fractured bones were not in good position, the longer was the limb fixed. With children such a procedure can usually be carried out with impunity as any stiffness of the neighboring joints is worked out with their activity, but with adults, and especially those beyond middle age, the fruits of prolonged fixation of joints become serious problems. Prolonged fixation is the most frequent mistake of the general practitioner doing a casual amount of fracture work and its results form the problem most often met with in a rehabilitation clinic. Frequently the problem is one that cannot be solved alone by massage, exercises or heat and active manipulation under anesthesia may have to be undertaken repeatedly to obtain satisfactory function in a joint. The advent of Pentothal as a form of anesthesia has greatly increased the satisfactory results of manipulations as the muscles are sufficiently relaxed and the patients usually do not have any postanesthesia nausea but rather have a feeling of well being so that they can immediately exercise the joint on their awakening from the anesthetic. This latter is most important in the prevention of recurrence of stiffness of the joint.

It is a sound surgical principle that the more correct the anatomic alinement of a fractured bone the more certain and the earlier does union occur. In the Sherman clinic we find that in about 20 per cent of cases of fractures of the long bones it is necessary to perform an open operation and apply internal fixation to the the fractured fragments in the shape of a molybdenum steel plate or screws in order that this correct anatomic alinement be obtained. We have proved conclusively that a properly applied plate or screws, and by "properly applied" I mean the use of careful aseptic technic and correct mechanical application of the plate or screws, does not in any may inhibit union but rather, by holding the bones firmly in good alinement, is favorable to early callus formation.[1] The open reduction and fixation of fractures should be done only as a matter of necessity, when a satisfactory alinement by closed methods has failed or is deemed useless to attempt. The decision to do an open reduction and plating is one not to be arrived at lightly. Not only is the operator's mechanical skill and technic thoroughly tested, but his associates, nurses and operating room organization are on trial and breaks in technic may be disastrous to the patient. During the past three or four years some interesting work has been done by the members of the fracture service of the Presbyterian Hospital of New York, and their actions are significant of the trend of the times. Murray[2] states, "We have reached the point where we operate by choice on all adults who have fractures of the femoral shaft, fractures of the tibia, and fractures of the humeral shaft, even though adequate position may be secured by nonoperative means." This of course is done to facilitate

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neighboring joint motion and to retain muscle tone and thus regain full function at an earlier date than otherwise. Rigid fixation in two planes is insisted on to balance the strain satisfactorily; a plate whose length is four or five times the diameter of the bone is used, and additional screws to supplement this are inserted to pass either directly or obliquely from one fragment through the other in a plane approximately at right angles to the plane of the screws holding the plate.

Up to the present time, it is our opinion that it is unwise to depend entirely on internal fixation to immobilize a fractured bone, and a lateral plaster splint, a Thomas arm or leg splint, should be used to supplement it. The principles, however, of firm fixation of fractures and early joint motion are well established. With properly applied plates, splints may be temporarily removed for motion of the joints, massage or other forms of physical therapy at an earlier date than if no internal fixation has been applied, and this leads to earlier return of function and thus a more rapid return to work.

During the last thirteen years in the interest of the efficiency of our clinic, the physical therapy administered during the convalescence of an injured patient has come to consist of a form of graduated muscular contractions more commonly known as the Smart technic, active exercises and heat.

Graduated[3] muscular contractions are obtained by a specially designed coil and interrupter devised by Sir Morton Smart twenty-five years ago. The operator is enabled to cause alternate painless contraction and relaxation of the whole of the injured muscle, or group of muscles, and the type of contraction produced so closely simulates the physiologic contraction of a muscle that the result is indistinguishable from a normal voluntary contraction.

This treatment should commence early since it has a beneficial effect in a number of ways. Physiologists say that the blood supply to a part is five times greater during action than at rest, and thus the blood supply to the part is stimulated. The patient himself sees the muscle going through its normal contraction and is encouraged voluntarily to use this muscle, which is the most efficient method of returning a muscle or joint to full function. The traumatic osteoarthritis following injury and the rarefaction of bones in the neighborhood of fractures are probably due to malnutrition of the muscles and capsule of the joint and other neighboring parts, and thus the efficient use of graduated muscular contractions prevents such malnutrition, or if it is established, counteracts it by the increased supply of blood which it brings to the part.

Massage relieves pain mechanically by increasing the flow of blood to the part, promoting absorption and preventing stagnation in the tissues, thus pressure is reduced and extravasated blood becomes broken up and dispersed. Passive movements are adopted with the idea of not allowing adjacent muscles to remain in apposition to each other, and so the lymph on their surface does not organize and so cause them to become adherent.

It is our feeling, based on the study of thousands of cases, that treatment by graduated muscular contractions is far superior to massage. What is accomplished with thirty minutes of massage can be done better with five minutes of graduated muscular contractions. My chief interest in this paper, however, is the influence of internal fixation on early motion of fractured limbs; but early motion has become so much a part of muscle stimulation and joint movement by graduated muscular contraction that where one leaves off and the other begins is indistinguishable. To clarify, let me in detail describe the normal course of man with a fracture of the shaft of the femur on whom it has been necessary to do an open reduction and application of a steel plate. After operation, usually ten to twelve days after frac-

ture, it being presumed that a substantial plate has been applied, the patient's leg is elevated in a Thomas splint with a Pearson attachment and the knee flexed about 35 degrees. The clips are removed from the skin on the fourth day, and it is at this time that the muscles of the thigh and lower leg are first gently stimulated by graduated muscular contractions. This is continued daily for a period of fifteen minutes, care being taken not to fatigue the muscles and the man is encouraged to note the effect of muscle stimulation on the movement of the leg muscles and to do likewise voluntarily. Two weeks after operation we commence to put the knee through gradually increasing ranges of motion, and by the end of the third or fourth week by means of a rope attached to the end of the Pearson attachment the man is encouraged to move the knee frequently himself through as much motion as we allow him. This is controlled by a rope between the distal ends of the Thomas splint and Pearson attachment and may be varied by the will of the surgeon. This range is gradually increased through the course of the convalescence and graduated muscular contractions are continued daily. Roentgen examinations are made at two or three week intervals, and usually about the ninth week bony union is present and the Thomas splint discarded. At this time the man has good motion in the joints of his leg and foot, muscle tone is fairly good and he is able to exercise his leg voluntarily quite well. When one compares this with the flat, flabby muscles, the stiff joints and complete weakness of a limb which has been encased in a plaster cast for ten to twelve weeks, one realizes that his patient has already made a tremendous stride toward recovery. It is interesting that the pinning of fractures of the neck of the femur and the subsequent active motion of the leg without weight bearing has greatly impressed many surgeons who have been accustomed to treating their fractures with prolonged fixation in a plaster cast. The good muscle tone and early full joint motion present here can be obtained in fractures of the long bones just as easily with proper intelligent care. Usually ten to eleven weeks after operation a Thomas walking caliper is applied, and the man is instructed to walk. His knee and hip are exercised daily and graduated muscular contractions continued, and the loss of muscle tone is rapidly repaired. The walking caliper is discarded at the end of about four and one-half months, and the man is ready to return to work in the steel mill, railroad or coal mine five or six months after injury. There are certain variations in this treatment; if there is considerable comminution in the femur the Pearson attachment may not be dropped until the sixth week, knee motion thus being delayed until that time, but graduated muscular contractions are commenced at the time the skin is healed. If a man is past middle age, eight months may elapse before he is able to return to hard, active work, but undoubtedly the security of internal fixation and the abolition of the plaster cast plus graduated muscular contraction and early voluntary motion not only make the patient much more comfortable during his convalescence but stimulate early bony union, and, most important of all, the patient's joint spaces and muscle tone are well on their way to normal when his fracture is united. Similar, though somewhat modified procedures are carried out with fractures of the tibia or forearm, in that the lateral plaster splint is removed temporarily, the joints exercised and graduated muscular contractions begun between the third and fourth week. In fractures of the humerus, muscular contractions are commenced with the arm still in the aeroplane splint and the man is encouraged to simulate the contractions produced by the machine by his own efforts. At Western Pennsylvania Hospital during the past ten years we have been presented with a number of fractures whose union has been

long delayed, and by means of the Smart technic only, these fractures have united. This was a cause of amazement to us but when one considers the increased flow of blood to the part it becomes quite comprehensible. It is our feeling that graduated muscular contraction has become of paramount importance in the treatment of fractures of the long bones, severe sprains or contusions. The time and trouble to master the technic of administration of the treatment is well repaid by the gratifying results obtained.

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Discussion

Dr. H. J. Jordan (New York, N. Y.): Dr. Foster stresses the advantages of internal fixation of fractures of the long bones, permitting early joint motion and muscle reeducation. He advocates the extensive use of graduated muscular contractions by electric stimulation.

I fully agree with Dr. Foster that treatment by graduated muscular contractions is the method of choice for rehabilitation of injured or atrophied muscles, and, that if properly applied, this treatment is superior to other modalities of physical therapy. Instead of the Morton Smart machine, we have been using the so-called "Tonisator" for more than fifteen years with similar good success.

I wish to emphasize Dr. Foster's conservative attitude toward open reduction and plating of fractures, especially his statement that this should only be done "as a matter of necessity, when a satisfactory alinement by closed methods has failed." I consider the necessity of open reduction a regrettable failure of our technic.

As far as early joint motion is concerned, my point of view differs. Solid bony union in best possible alinement is our chief concern. Nothing should interfere with the rule of never-interrupted immobilization until solid bony union has occurred. I do not believe that prolonged immobilization of joints under adequate conditions leads to serious complications. The stress is on adequate conditions.

The skin-tight plaster of Paris cast, properly applied, for the majority of fractures is, in my experience, still superior to internal fixation. It is much more important to have the patient ambulatory at the earliest possible moment and, in fractures of the lower extremities, to have him bear weight on the fractured extremity, than to have early access to the muscles. It has been proved conclusively that "protected weightbearing" is the best stimulus for callus formation. The active use of the extremity as a whole maintains good circulation and reduces muscular atrophy to a minimum. I therefore insist on early "protected weightbearing" even in cases in which internal fixation could not be avoided.

In fractures of the upper extremities the advantages of internal fixation are obvious. Conservative judgment in the selection of the cases, as outlined by Dr. Foster, will give results which justify the more frequent use of internal fixation.

Dr. Francis Glenn (Miami, Fla.): The use of internal fixation of fractures has been used for many years with varied results. The excellent results obtained, such as those presented in this essay, tend to stimulate the medical profession and even the laity to say "why don't we do this more often?" This can be a dangerous kind of enthusiasm because on paper it looks so simple and there is a tendency to overlook the fundamental principles involved.

Dr. Foster did not have time to go into much detail in a presentation of this sort but he did devote considerable space in the early part of his paper to several important points. First the cases were carefully selected and it was found necessary to operate in only 20 per cent of fractures of the long bones. Secondly, the "proper application" of the plate was emphasized and this is important. Here is where most of the failures occur. Not many general hospitals have sufficient armamentarium including a large selection of screws and plates of various sizes and made of an inert metal. Too often then the materials used are not adequate to secure proper immobilization to carry out the routine recommended here. They use what they have and hope for the best. Too much dependence cannot be placed on the plate and screws alone.

He also points out another important procedure, taking roentgenograms in two planes at intervals of two to three weeks. In this way we can detect any tendency for the screws to loosen as they may do in some cases no matter how firm they may appear at operation. The progress of callus formation can also be followed.

The principle of early movement in fractures of the long bones is excellent so long as it does not interfere with healing of the bone. Injuries to the soft tissues about the fracture site are just as im-

portant as the injury to the bone itself. Every fracture of a bone is attended by some soft tissue damage. In fractures of the shaft of the femur, for example, closed reduction is rendered difficult and sometimes impossible in many cases by the interposition of muscle and the tough intermuscular septum which may be caught between the roughened ends of the bone. There is hemorrhage and entravasation of tissue fluids and lymph which must undergo repair. The neighboring joint structures may be injured or may become involved indirectly by too long immobilization. Early movement prevents contractures.

Circulation is of importance in the healing of any of the tissues of the body. This is especially true of bone healing. Bone is in a constant state of "flux" and must be considered as such a tissue. In fractures of the shaft of the long bones we are dealing with cortical bone where the circulation is especially vulnerable and the formation of healthy granulation tissue is slow and is easily delayed or destroyed by movement of the bone ends. Delayed union and nonunion are not common for this reason.

I would like Dr. Foster to give us some idea of the percentage of firm bony unions obtained and also his explanation for delayed union or nonunions if they have had any.

I want to thank the essayist and the committee for the privilege of discussing this paper.

Dr. James A. Dickson (Cleveland, Ohio): It gives me much pleasure to have this opportunity to discuss Dr. Foster's interesting paper.

I heartily endorse the principles which he so aptly stressed in his presentation. With any fracture of the extremities, adequate reduction must be procured—then proper fixation to give rest and immobilization to facilitate union. If this were all that had to be considered the problem would be simplified. Unfortunately, too prolonged fixation is definitely detrimental to the return of motion in the joints above and below fractures. So we have two conflicting principles to follow. First there is fixation of the fracture and avoidance of motion to facilitate repair; second, there is early motion in the joints above and below the fracture to minimize the resultant stiffness in the joints and definitely shorten the convalescence. The best surgical judgment is dependent on the evaluation and correlation of these two principles. Certainly earlier motion can be instituted when we have internal fixation of the fracture but no manipulation should be carried out that would throw a strain on new forming callus. Muscle contraction by means of the Smart coil and the voluntary muscle contractions which Dr. Foster has emphasized certainly are beneficial as they increase the lymph and blood flow which aid in repair. With proper immobilization apparatus undue strain is not thrown on the new forming bone, which is particularly true when proper internal fixation is used.

During the last war, and for many years after, teaching and practice were largely against the use of internal fixation. Dr. Sherman and Dr. Foster and their associates have steadfastly maintained the advantages of such procedures and have shown that with suitable metals and meticulous technic the results obtained with internal fixation certainly justify this method of treatment. In the last few years the development of vitallium and molybdenum steel which are non-oxidizing in the presence of body fluids has greatly stimulated the internal fixation of fractures. In consequence, superior results are being obtained with open reduction.

In spite of these definite improvements in metals and technic I wish to re-emphasize Dr. Foster's statement, that cases for open operation must be wisely chosen as such procedure are not without a certain degree of risk.

The emphasis that Dr. Foster has placed on the convalescent treatment of fractures is a timely message and if followed will do much to improve the results in fractures of the extremities.

Dr. George Vance Foster (closing): I wish to thank my discussors for their very able presentations.

Dr. Glenn brought up the question of the percentage of nonunions. No review has been made since 1932, at which time we reviewed a large number of cases, and we found that we had delayed and nonunions of two to three per cent. I have forgotten the exact fraction. This was similar, whether the bone was plated or whether the bone was not plated, which was the important part to us. In compound fractures the rate of nonunion was, I believe, five per cent.

MEDICAL NEWS

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Dr. Chavez Opens Clinic

Dr. Nicandro Chavez has the honor to offer his services in his Clinic of Physical Therapy at Calle de Queretaro No. 51, Mexico City, Mexico.

Greetings From Across the Sea

The recent Annual Session of the American Congress of Physical Therapy served as an opportunity for the expression of cordial sentiments from across the British Isles.

The following cabled message was received from Sir Morton Smart and read at the Congress Dinner at Pittsburgh on September 9th: "As explained by letter, I greatly regret being unable to accept your invitation to attend Congress of Physical Therapy. The demand for sceintific physical therapy in all countries is insistent. Physical Therapy in peace time is in all parts of the world slowly, but steadily, becoming recognized as of paramount importance to the community and this world war should be its great opportunity. Much of its progress is due to the efforts and teaching of your Congress, and its activities and that of many other physical therapy organizations in your country manifest to the world at large the importance of the scientific control of physical therapy. I wish your Congress the greatest success and good luck, to your members for their continued interest and enthusiasm in doing so much to improve the status of physical therapy."

Reverberant applause followed the reading of this stimulating message and similar approval was heard after the reading of excerpts from a letter of Dr. D. Hay Scott, Editor of the *British Journal of Physical Medicine and Industrial Hygiene.*

Academy of Physical Medicine

The twentieth annual meeting of the American Academy of Physical Medicine was held at the Statler Hotel, Boston, October 14-17, under the presidency of Capt. William Seaman Bainbridge, M. C., U. S. Naval Reserve, New York. The first session was devoted to a consideration of "Physical Medicine in the Services" with the following speakers: Col. Edgar Erskine Hume, M. C., U. S. Army, Carlisle, Pa., in army activities; Capt. William E. Eaton, M. C., U. S. Navy, Great Lakes, Ill., in the naval hospital; Dr. Charles M. Griffith, Washington, D. C., in the veterans administration; Dr. Andre William Reggio, Boston, the role of the physician in civilian defense; Sir Robert Stanton Woods, London, read by Dr. William D. McFee, Boston, the care of the civilian casualties in England, and Drs. Frank H. Krusen and Earl C. Elkins, Rochester, Minn., the teaching of physical medicine in relation to the war effort. Other speakers on the program included:

Dr. Frank H. Lahey, Boston, Some Problems of Medicine in Relation to the War.

Kurt S. Lion, D.Eng., Cambridge, Mass., Method of Determining Dosage and Local Distribution in Short Wave Therapy.

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ARCHIVES of PHYSICAL THERAPY

OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL THERAPY

.·. EDITORIALS .·.

THE CONGRESS AT PITTSBURGH

In spite of the difficulty of traveling, increased demands made on the physicians at home and the fact that many of the younger members of the Congress are now in the armed forces, the meeting was well attended.

Pittsburgh, the great industrial city, was even more impressive than usual with its war industries and organized scramble and fervor for more production of the weapons of war. The members of the medical profession of the city made every endeavor to make the meeting a success and the sojourn of those from outside the city a pleasant one. They indicated considerable interest in the meeting. Several of the participants were from the medical centers of the city and were on the scientific program of the Congress.

There seemed to be more enthusiasm and even more sincere and urgent desire for knowledge concerning the field of physical medicine than is usual. Everyone was cognizant of the crisis the nation now faces and the responsibility which may fall to physical medicine in the rehabilitation of the injured, which may result from a large combat army.

One could not help but compare the field of physical medicine largely a product of the last war with the sons of the soldiers of the last war, both young, both hardly over their growing pains, both wanting to do their duty to the utmost in the present preparation and promotion of the war.

The scientific program was composed of interesting and practical subjects, as well as highly scientific problems in which new and important research had been done. Among the panels of special interest was that on the much discussed and publicized problem of the treatment of anterior poliomyelitis. The discussions, although controversial, were stimulating in thought and indicated the somewhat revolutionary trend in the treatment of this disease. There was much interest in the excellent stimulating presentation of "Physical therapy in certain medical conditions," by George Morris Piersol and likewise, the paper which appears in this issue on the "Refinement in treatment of arthritis, especially in relation to physical therapy," by Pemberton. There was considerable interest in the paper on the "Recent studies on the physiology of speech production," which also appears in this issue of the ARCHIVES. The paper was highly scientific and it indicated careful study, ingenuity and extended scientific knowledge. The scientific exhibit, which won the Gold Medal award, was on the same subject by the same authors and did much to stimulate interest in this particular paper. There were many other papers of equal interest and importance, all ably discussed. Most of these papers will appear in later issues of the ARCHIVES.

The scientific exhibits were interesting and well done. However, the evidence of war crept in as indicated both by the fact that there were exhibits in relation to problems of war time and by the fact that new research problems were not as evident as might be expected in time of peace.

The lectures in the instruction course were well attended. These lectures were given to those who had made application for the course by men

especially trained in the branches of physical medicine in which they lectured. There seemed to be a trend toward more emphasis on the importance of education in relation to physical medicine than is usually apparent at the Congress.

The annual dinner was one of the high lights of the meeting. Fred Moor, the new president, was acting as toastmaster. Owing to circumstances, which necessitated the absence of Captain Stephenson of the United States Navy, Buerki, Dean of the Graduate School of the University of Pennsylvania, gave the address of the evening. His remarks were timely, interesting and stimulating and were most enthusiastically received.

Mr. Edward O. Tabor of the Pittsburgh Chapter of the American Red Cross gave a short address and extended his best wishes in behalf of Pittsburgh to the members of the Congress.

Lt. Col. Norman Titus made an urgent plea to the members of the Congress to extend their services to the armed forces in order to assist in filling the need for medical officers trained in the field of physical medicine.

Disraeli Kobak, Chairman of the Awards Committee, presented the Gold Key award and the awards for the scientific exhibits.

The Congress completed one more year of progress in the advancement of physical medicine. To those responsible for planning and arranging this excellent meeting during these changing times, much praise should be given.

THE GOLD KEY AWARD OF 1942

The Gold Key award of our Congress is an accolade of distinction presented annually at this time to one or more persons who by his or their special contributions to the science of Physical Medicine are recognized for their particular value to our times and the healing art. The order of the Gold Key of the American Congress of Physical Therapy numbers among its distinguished members persons from every land whose services have been the means of alleviating suffering and raising the stature of our practice to a level commensurate with the dictates of science and the highest demands of our discipline.

It is timely to recall that throughout the ages no other group more than our profession has so persistently fought and sacrificed for health and opposed the destructive forces of disease by a program of construction which awarded highest merit to those who contributed to the best means of protecting the weal of our fellow men. The Congress under the direction of its governing body, the officers of this organization, is pleased to do honor to a person whose sacrifices, courage and persistent efforts have brought new hope, considerable relief and even the promise of marked improvement to a host of infants, children and adults suffering from a scourge that heretofore challenged our best classical methods of treatment. In the hands of this pioneer, old procedures in our armamentarium have

been used and suggest that a new orientation in their application in relation to spastic and paralytic structures has been created.

Citation. — Elizabeth Kenny, age 54, native of Australia and graduate registered nurse, began the study of infantile paralysis and her special contribution thirty years ago. She was then serving as a nurse subject to service in the interior of Australia, a service that is designated as a "bush nurse," because it delegated the work to the wastelands, scattered homes and primitive abodes of a population that saw little of the physician and were often entirely dependent on a nurse. Her initiative and practical turn of mind were her richest assets in the presence of a series of clinical crises that would have called for the highest endeavors of our profession. Her ingenuity turned the only tools of nature at her disposal into curative weapons. Perseverance, imagination and careful observation fashioned these physical tools into a creative and new therapeutic approach to the management of anterior poliomyelitis, and an extraordinary experience which hardened body and intellect to resist the tragedies of life in the bushlands helped to formulate her future program to a clarity that eventually won for her the support of governmental and medical bodies in Australia. She came to America at the expense of the Australian government for the purpose of furthering her research and in the hope of disseminating her special experience for the greater good of mankind.

Her success in this country is a tribute to three American physicians, Drs. Wallace H. Cole, Miland E. Knapp and John F. Pohl. Their cooperative endeavors were and continue to be of such a high standard that their names will always be coupled with the successful proof of the treatment. The work carried out in the department of Physical Therapy and under the supervision of the Orthopedic Service at the University of Minnesota established the fact that out of a comparatively large series of acute cases, all became free of contractural deformities, all were free from abdominal and back paralysis and only a small fraction retained a residual paralysis of the extremities. This is but a beginning of a vast promise bearing the potentiality of good to an affection whose morbidity has in the past been the story of one of our greatest tragedies. To Elizabeth Kenny is accorded the special distinction of being the first female in the history of our Congress to receive the Gold Key Award, and to Drs. Cole, Knapp and Pohl, honorary mention for services of the highest quality.

AWARDS TO SCIENTIFIC EXHIBITORS

The Committee of Awards for Scientific Exhibits presented through its Chairman, Dr. Disraeli Kobak, the following awards:

The Gold Medal to Dr. *O. Leonard Huddleston* and *Adaline S. Bullen* of the University of Colorado School of Medicine for their exhibit depicting principles of speech analysis.

The Silver Medal to Drs. *Karl Harpuder* and *Irvin D. Stein,* Montefiore Hospital, New York, photographs of minute blood vessels.

The Bronze Medal to Dr. *Kristian G. Hansson* and *Florence Liljander,* Hospital for Special Surgery, New York, exercises for low back strain.

Honorable Mention to Dr. *Joseph Kovács,* Post Graduate Medical School and Hospital, New York, diagnosis and treatment of leg ulcers.

Professor Georges Lakhovsky
1870-1942

In the recent death of the eminent physicist Georges Lakhovsky which took place in New York City where he had sought refuge from a war torn France, physical therapy lost one of its most distinguished researchers in the domain of short wave radiation. Born in Russia where he was graduated in 1894 as a mechanical engineer, he left the same year for France which became his second fatherland. After additional training in various fields of related science and fine arts he early showed an inventive genius by creating appliances that facilitated better and safer railroad transportation, inventions which were utilized by the French Government during World War I and earned him the distinction of the Legion of Honor. After that war he became deeply interested in radio physics and endowed a foundation named for him in which he became associated with a number of eminent inventors, each of whom made some epochal contribution to the then new science of radio transmission.

His personal interest in short wave biophysics led him to investigate the effect of the ultra-high frequency current on plant life. In the study of this problem he devised a special oscillator of 2 to 10 meter wavelength with which he successfully treated geranium plants inoculated with bacillus tumefaciens. It is interesting to recall that this inoculation causes plant cancer which heretofore had not yielded to any form of plant therapy. This original method of investigation was carried out in the surgical department of the Salpetrière between the years of 1922 to 1924, in collaboration with its chief, Professor Gosset and his staff. The results were presented before national and international congresses on radio-biology which officially recognized the merits of Lakhovsky's research. Today it must be admitted that to him belongs the credit of being the creator of short wave therapy because his labors have stimulated clinical research with this agent by a number of clinicians in various lands.

On the assumption that one and the same wavelength cannot be universally applied to all human beings with divers pathologic conditions due to cellular risks incident to undue heat concentration, Lakhovsky was in the midst of an extensive study concerning the physiologic and clinical value of electrostatic multiple wave oscillations when the outbreak of the present war destroyed the facilities for creative effort. He fled France under the protection of the French Government because his many writings expressing the fallacy of anthropologic quibbling had incurred the hatred of the Nazi régime. It was unfortunate that shortly after having found in hospitable America an opportunity to continue his important work, death stilled his fertile brain. Animated by the love of suffering humanity characteristic of the true scientist his works will remain alive, and his monument will be the great service he has rendered the science of biophysics.

D. K.

Medical News
(Continued from Page 614.)

Drs. Walter J. Zeiter and Albert D. Ruedemann, Cleveland, Further Observations on the Use of Short Wave Diathermy in Lesions Involving the Orbit.

Dr. Frank R. Ober, Boston, Physical Medicine in the Treatment of Lame Backs.

Francis O. Schmitt, Ph.D., Cambridge, Biologic Investigation of Medical Interest with the Electron Microscope.

Robert S. Harris, Ph.D., Cambridge, Appraisal of Nutritional Status in Human Beings.

Dr. Herman A. Osgood, Boston, The Treatment of Epithelioma by Electrosurgery and by X-Rays.

A symposium on the after-care of poliomyelitis was a feature of the meeting on Friday with the following speakers: Drs. Ober, Boston; William Benham Snow, New York; Kristian G. Hansson, New York; William T. Green, Boston; Mark Joseph Daley, New York, and Robert L. Bennett, Jr., Warm Springs, Ga. Dr. Winifred Overholser, Washington, D. C., delivered the Arthur H. Ring Foundation Lecture Friday evening. On Saturday morning the practice of physical medicine at the Massachusetts General Hospital was shown in case presentations covering the peripheral nerve injuries, poliomyelitis and rheumatoid arthritis.

Agencies Represented at the Meeting on Rehabilitation

Roosevelt Hotel, New York City August 15-16, 1942

American Academy of Orthopedic Surgeons (570).

American College of Physicians (4,595) — Dr. Charles F. Tenney.

American College of Surgeons (12,919) — Dr. Malcolm MacEachern.

American Association of Industrial Physicians and Surgeons (1,200) — Dr. E. C. Holmblad.

American Association of Medical Social Workers (2,052) — Miss Harriet M. Bartlett (or Sadie Shapiro).

American Association to Promote the Teaching of Speech to the Deaf (2,200) — Josephine B. Timberlake.

American Association of Psychiatric Social Workers (517).

American Congress of Physical Therapy (450) — Dr. John S. Coulter.

American Foundation for the Blind.

American Hospital Association (5,233).

American Nurses' Association (167,201) — Carmelita Calderwood.

American Medical Association (119,670) — Dr. Louis Bauer.

American Occupational Therapy Association (1,301) — Marjorie Fish.

American Public Health Association (7,000) — Dr. Don W. Gudakunst.

American Physiotherapy Association (1,450) — Catherine Worthingham.

American Psychiatric Association (2,701) — Dr. Mabel Huschka.

American Public Welfare Association (2,500) — William Hodson.

American Red Cross — Dr. Albert McCown, Medical Director.

American Registry of Physical Therapy Technicians (1,500) — Dr. William Bierman.

American Society for the Hard of Hearing — Mrs. Laura Stovel.

American Speech Correction Association (250) — Dr. Herbert Koepp-Baker.

American Vocational Association, Inc. (25,418) — Charles W. Sylvester.

Conference of Executives of American Schools for the Deaf — Edmund B. Boatner.

Council on Physical Therapy of the American Medical Association — Dr. John S. Coulter.

Institute for the Crippled and Disabled.

International Council for Exceptional Children (4,000) — Dr. Hugh G. Rowell.

Kiwanis International (114,000).

Lions Club (150,000) — Alexander T. Wells.

National Association of Goodwill Industries (80 organizations).

National Committee for Mental Hygiene (5,000) — Dr. Emily Burr.

National Foundation for Infantile Paralysis — Dr. Don W. Gudakunst.

National Industries for the Blind.

National League for Nursing Education (7,144) — Carmelita Calderwood.

National Organization for Public Health Nursing (11,500) — Ruth Houlton.

National Society for Crippled Children of the United States of America (40 state organizations) — Mr. Harry H. Howett.

National Society for the Prevention of Blindness (17,000).

National Vocational Guidance Association (3,408).

National Tuberculosis Association (1,932) — Mr. Holland Hudson.

National Urban League (25,000) — Mr. Franklin O. Nichols.

Society of Physical Therapy Physicians (70) — Dr. J. S. Coulter.

U. S. Department of Labor — Children's Bureau — Dr. A. L. Van Horn.

Y. W. C. A. (530,000) — Mrs. Douglas T. Henderson.

Meeting of National Foundation

The Third Annual Medical Meeting of the National Foundation for Infantile Paralysis will be held in New York City on December 3-4, inclusive.

Kenny Unit to Be Set Up in Public Health Center

Plans are under way to establish clinics and hospitalization for the treatment of anterior poliomye-

litis and its resultant paralysis at the Public Health Center, Minneapolis, formerly known as the Lymanhurst Health Center. The clinics would be under the direction of Sister Elizabeth Kenny, who has been in Minneapolis for some time directing work of this kind.

Conference on Venereal Disease Control Needs in Wartime

Venereal disease and America's war effort will be discussed by high-ranking medical officers of the War and the Navy Departments, prominent physicians, health officers and others at a Conference in Hot Springs National Park, Arkansas, October 21-24, 1942. Headquarters will be at the Arlington Hotel.

The Conference will be held under the auspices of the United States Public Health Service in conjunction with the Eighth Annual Meeting of the American Neisserian Medical Society. Surgeon General Thomas Parran will preside. State and local health officers, venereal disease control officers, practicing physicians, and all others engaged in venereal disease control activities are urged to attend.

Subjects for discussion will include venereal disease control measures influencing the war effort, epidemiology of syphilis and gonorrhea — 1942, wartime venereal disease control education, research influencing the wartime venereal disease control program, and technics of venereal disease education.

Governmental, professional and health organizations to be represented at the Conference include: the War Department, the Navy Department, the Social Protection Section of the Office of Defense Health and Welfare Services, the American Medical Association, the American Neisserian Medical Society, the American Social Hygiene Association, State and local health departments, and the United States Public Health Service.

Malpractice: Alleged Improper Application of Diathermy Treatment

The physician defendant in the course of treating an injury to the plaintiff's left hand and arm recommended stated diathermy treatments. Accordingly the defendant Dyer, who was not a physician, applied in the physician's presence a diathermy treatment of the strength and duration prescribed by the physician. Some time later a treatment of the same strength and duration was again given. Apparently painful and permanent injuries resulted. The plaintiff brought suit against both the physician and the layman, charging that there was a joint duty on the part of both of them "to see that said diathermic treatment was properly administered and that the machine was properly operated and that the treatment was suspended and terminated at the proper time so as to prevent injury." It was charged that the defendants failed in this obligation and "carelessly and negligently caused an electrical current of an amperage specified and directed by (the physician) to pass from said machine through the plaintiff's said left arm and hand for said period of twenty (20) minutes, although the said (physician) and (diathermist) knew, at the expiration of twenty minutes that the treatment was inflicting severe pain upon the arm and hand of the plaintiff. . . ." The electrical current, the declaration charged, in both treatments was negligently applied under the negligent and careless personal supervision and direction of the physician, and the treatment lasted continuously for twenty minutes notwithstanding the remonstrances on the part of the patient that it was causing her great pain. A demurrer interposed by the physician was sustained and judgment was entered in his favor. The patient then appealed to the Supreme Court of Florida.

Each of the defendants, the physician and the diathermist, acted within a definite sphere, said the Supreme Court. It was the physician's responsibility to advise such treatment as is generally accepted by the profession as the one most likely to cure or relieve the particular injury from which the patient was suffering when she consulted him. It was the duty of the diathermist to apply the heat of a strength and duration designated by the physician. His duty was expertly to follow the instructions given by the physician. There was no claim that the remedy itself, that is the application of electrical current, was improper for one in the patient's condition nor that there was failure on the part of the diathermist to follow the prescription of the physician. Neither was there a charge that the machine was defective. The substance of the allegation is that the intensity of the heat, the duration of the treatment and the repetition of it constituted negligence resulting in injury. There is in the complaint not only insufficient averment of facts showing negligence but also of facts indicating "unity of design" or "violation of . . . joint duty" owing by both defendants. This is far from showing that there was a joint tortious act on the part of the defendants or concert of action between them, which is necessary to fasten liability on them on the theory that they were joint tort-feasors. The patient contended that the allegations of the declaration abundantly show the characteristics of joint tort-feasorship, citing in support of the contention 2 cases, *Louisville & N. R. Co.* v. *Allen*, 67 Fla. 257, 65 So. 8 and *Feinstone* v. *Allison Hospital, Inc.*, 106 Fla. 302, 143 So. 251, which held that if acts of negligence although distinct in themselves concur in producing an injury the persons guilty of negligence are joint tort-feasors and are jointly and severally liable for the injury. Even granting that rule, however, the court did not believe that it could be applied to the facts in the present case. Even granting, said the court, that the rule is in Florida that when the negligences of two or more persons concur in producing a single, indivisible injury, then such persons as joint tort-feasors are jointly and severally liable, although there was no common duty, common design or concerted action, we still are unable to discern in the pleading allegations which if proved would establish that there was negligence on the part of the physician in his field and on the part of the diathermist in his which concurred in the eventual injury. And the court was not influenced by the charge that the

physician was present at the time of the treatment.

The judgment of the lower court in favor of the defendants was accordingly affirmed. — *Hudson v. Weiland, 8 So. (2d) 37 (Fla., 1942).* — [Reprinted with permission, J. A. M. A. **119**:1526 (Aug. 29) 1942.]

Diathermy Machine Seized in Alien Raid

On May 23 newspapers reported that a short wave radio transmitter of the diathermy machine type, capable of transmitting messages 50 miles out to sea, was seized by Federal Bureau of Investigation agents in one of thirty-eight raids which they made the previous evening on the homes of aliens of enemy nationalities in different sections of New Jersey. The apparatus was found in the home of a 36-year-old unmarried German, who said he bought the machine for use in treating rheumatism but admitted that he had never consulted a physician concerning such an ailment. The man was arrested. A recent order by the federal communications commissioner directs all owners of diathermy machines to register them with the commission. — [Reprinted with permission, J. A. M. A. **119**:507 (June 6) 1942.]

The American Society for the Hard of Hearing Elects Dr. Gardner President

Warren H. Gardner, Ph.D., was recently elected President of the American Society for the Hard of Hearing. Dr. Gardner is Consultant in Hearing and Vision, Oregon State Board of Health, Portland, Ore. Dr. Gardner has served as hearing supervisor at the Indiana University Speech and Hearing Clinic. Under the able leadership of Dr. Gardner, the American Society for the Hard of Hearing, which has its headquarters in Washington, D. C., will continue its two-fold purpose of (1) preventing deafness by early discovery of hearing losses in children, followed by medical treatment; and (2) rehabilitation of adults and young people who have already lost part of their hearing.

The American College of Physicians Will Hold Its 1943 Session in Philadelphia, April 13-16, 1943

The American College of Physicians has announced its 27th Annual Session to be held in Philadelphia, Pa., April 13 to 16, inclusive, 1943. Heretofore, the College has held a five-day Session, but in the interest of conserving time and expense of its members, the program will be condensed into four days, Tuesday through Friday. Dr. James E. Paullin, Atlanta, as President of the College, will have charge of the program of General Sessions and Lectures. Dr. George Morris Piersol, Philadelphia, as General Chairman, will be responsible for the program of Hospital Clinics, Panel Discussions, local arrangements, entertainment, etc. The general management of the session and technical exhibits will be handled by the Executive Secretary, Mr. E. R. Loveland, 4200 Pine St., Philadelphia.

Other medical societies are urged to avoid conflicting dates, for our mutual benefit.

Federal Trade Commission Issues "Cease and Desist" Order Against All False Diathermy Advertising

An important step has been taken in protecting the public against misrepresentation in advertising diathermy apparatus for self-use by lay persons. After taking due evidence and hearing arguments by counsel, the Federal Trade Commission issued on July 20, 1942, a sweeping order against the United Diathermy, Inc., and all other devices or apparatus of substantially similar character.

The order states that these concerns forthwith cease and desist from directly or indirectly disseminating or causing to be disseminated, by means of the United States mails, or by any means in commerce, (as "commerce" is defined in the Federal Trade Commission Act) any advertisement concerning the electrical device or apparatus designated "United Short Wave Diathermy"; (or disseminating or causing to be disseminated any advertisement, by any means, for the purpose of inducing, or which is likely to induce, directly or indirectly, the purchase in commerce, as "commerce" is defined in the Federal Trade Commission Act, of the electrical device or apparatus designated "United Short Wave Diathermy,") which advertisement:

1. Represents, directly or through inference, that said device or apparatus is safe or harmless;
2. Represents, directly or through inference, that said device or apparatus has any therapeutic value in the treatment of arthritis characterized by infection, bursitis where the condition is acute, sinus trouble in which there is a retention of pus, or any disease or condition involving an acute inflammatory process;
3. Represents, directly or through inference, that said device or apparatus constitutes a competent or effective treatment for rheumatism, arthritis, neuritis, bursitis, lumbago, sciatica, neuralgia, sinus trouble, or colds, or for the alleviation of pain resulting from any of said disorders or ailments, unless such advertisement is specifically limited to those cases of such disorders or ailments which do not involve acute inflammatory processes;
4. Fails to reveal clearly, conspicuously, and unequivocally that said device or apparatus is not safe to use unless and until a competent medical authority has determined as a result of diagnosis that the use of diathermy is indicated and has prescribed the frequency and rate of application of such diathermy treatments and the user has been thoroughly and adequately instructed by a trained technician in the use of such diathermy device or apparatus.

Health Center Turned Over to Sister Kenny

The Minneapolis *Journal* reported on August 13 that the Public Health Center was to be turned over to Sister Kenny to establish a treatment center for poliomyelitis. This decision was reached at a meeting of the board of public welfare on August 12

and was a gesture of appreciation to Sister Kenny for establishing Minneapolis as her headquarters while in this country. Newspapers report that the Kenny clinic would be set up in the Public Health Center as soon as arrangements had been completed to move clinics that now occupy the building.

Dr. Seeger Named Industrial Hygiene Consultant

Dr. Stanley J. Seeger, Texarkana, Texas, chairman of the Council on Industrial Health of the American Medical Association, has been named consultant to the division of industrial hygiene of the National Institute of Health, according to *Industrial Hygiene*. Dr. Seeger will maintain contact with the state and county medical societies to acquaint physicians with the growing importance and demands of practice.

Physical Hardening Program

The board of regents of the University of Michigan, Ann Arbor, has approved a physical hardening program which will be compulsory for all men students. The men students will be required to participate in three ninety minute sessions each week with the emphasis on calisthenics, obstacle races, swimming and a variety of competitive activities designed to produce physical fitness.

Dr. Ebaugh to Serve as Psychiatric Consultant

Dr. Franklin G. Ebaugh, Denver, has been granted a leave of absence as medical director of the Colorado Psychopathic Hospital and professor of psychiatry at the University of Colorado School of Medicine, Denver, for the duration of the war. He has been commissioned a lieutenant colonel and will serve as chief psychiatric consultant of the eighth service command with headquarters at Fort Sam Houston, San Antonio, Texas.

New Head of Navy Medical School

Capt. Charles W. O. Bunker, commander of the Naval Medical School, Bethesda, Md., on September 14 was assigned to command the Naval Medical Center at Bethesda and was nominated for promotion to rear admiral. He succeeds Rear Admiral Charles M. Oman, who will become commanding officer of the Naval Convalescent Hospital, Harriman, N. Y.

Wesley Hospital to Be a Venereal Disease Clinic

The old Wesley Memorial Hospital will be used to house a venereal disease clinic, operated by the city with the aid of government funds. The allocation from the Federal government offered by the Federal Works Agency will be for the equipment of the hospital and for its maintenance and operation for one year.

School for Physical Therapy Technicians

Dr. Edwin N. Kime, professor and chairman of the department of anatomy, Indiana University School of Medicine, Indianapolis, has been named to organize and head a school for physical therapy technicians at the medical school to help meet the demands of such specialists by the armed forces. The course will last six months for a total of 1,000 hours, including 200 hours of clinical practice following 800 hours of theory and laboratory work. Students eligible for admission include graduates of approved schools of nursing, graduates in physical education and persons who have received two years of college work which included general physics, general biology and general chemistry. Graduates of the course will be eligible for the U. S. Civil Service rating of apprentice physical therapy aid and therefore become eligible for service in the armed forces. After six months of satisfactory experience the student may be promoted to the rank of physical therapy aid by the U. S. Civil Service Commission.

The Hospital Corps of the United States Navy

This is the title of a descriptive, free booklet on the Hospital Corps of the United States Navy. From this booklet we learn that men with acceptable training in one of the auxiliary fields of medicine, if otherwise qualified, may enlist directly in the Hospital Corps of the U. S. Naval Reserve with rating up to Pharmacist's Mate, second class. The base pay of this rating is $96.00 per month, and men with dependents may receive, in addition, a quarters allowance of $37.50 per month. A complete outfit of clothing is provided all men on first enlistment.

Men who are accepted, with rating in the Hospital Corps based upon their civilian professional training, should receive rapid promotions in view of their special knowledge and the continuing expansion of the Navy. Enlistment in the U. S. Naval Reserve is for a period of two, three, or four years, subject to extension for the duration of the war.

The Bureau of Medicine and Surgery, Navy Department, Washington, D. C., will be pleased to supply additional copies on request.

Society of Physical Therapy Physicians New Officers, 1943

President—K. G. Hansson, M.D., New York, N. Y.
President-Elect — William H. Schmidt, M.D., Philadelphia.
Vice-President — Fred B. Moor, M.D., Los Angeles.
Secretary-Treasurer — Milton G. Schmitt, M.D., Chicago.

Membership Committee — Disraeli Kobak, M.D., Chicago; William H. Schmidt, M.D., Philadelphia; Nathan H. Polmer, M.D., New Orleans; Miland E. Knapp, M.D., Minneapolis; Madge C. L. McGuinness, M.D., New York, N. Y.

Program Committee — Richard Kovács, M.D., New York, N. Y.; Frances Baker, M.D., San Francisco; Charles R. Brooke, M.D., Newark, N. J.

The Early Physical Therapy of Poliomyelitis Demonstrations of Kenny Technic

The New York Academy of Medicine is holding its Fifteenth Annual Graduate Fortnight, October 12 to 23, on the subject of "Disorders of the Nervous System." Under the supervision of Don. W. Gudakunst, Medical Director of the National Foundation for Infantile Paralysis, Inc., demonstrations of the Kenny Technic will be held each evening. The schedule is as follows:

First Week

Monday evening, October 12—Philip Stimson, Don W. Gudakunst.

Tuesday evening, October 13—K. G. Hansson.

Wednesday evening, October 14—William Benham Snow.

Thursday evening, October 15—William Bierman.

Friday evening, October 16—Richard Kovács.

Second Week

Monday evening, October 19—Philip Stimson, Don W. Gudakunst.

Tuesday evening, October 20—K. G. Hansson.

Wednesday evening, October 21—Richard Kovács.

Thursday evening, October 22—William Bierman.

Friday evening, October 23—William Benham Snow.

"CLINICS" — New Publication

The editors and publisher of the *New International Clinics*, in response to the increased tempo of medical progress have started a new publication called *Clinics*, which will be issued bimonthly instead of quarterly, as was the older publication, the *New International Clinics*. Dr. George Morris Piersol, professor of medicine, Graduate School of Medicine, University of Pennsylvania will edit the new periodical and will have the collaboration of a group of distinguished physicians from various medical centers.

Dr. Roy Halloran on Duty in Surgeon General's Office

Dr. Roy D. Halloran, Superintendent, Metropolitan State Hospital, Waltham, Mass., has been assigned to duty as consultant in neuropsychiatry in the Surgeon General's office, Washington, D. C. Dr. Halloran will coordinate the neuropsychiatric service in the army both in this country and overseas.

Rehabilitation Program for the Tuberculous

The appointment of Mr. Floyd L. Kefford, of Philadelphia as a special tuberculosis agent on the staff of the Reading, Pa., district of the State of Pennsylvania bureau marked the beginning of the second cooperative rehabilitation program in which tuberculosis organizations in Pennsylvania are joining with official agencies.

A Message From Russia

The following inspiring wireless message from Moscow has been received by Dr. Richard Kovács in his capacity as President of the International Medical Club of New York.

"Le 332N, 152 wireless via Mackay Radio-N Mossow, 15, 0154, Professor Richard Kovács, President, International Medical Club, 2 East 88th Street, New York City.

"Permit me through you to greet my colleagues, the physicians and surgeons of America—stop— we doctors and medical scientists of Soviet Union have today largely placed our practical and scientific work on war footing and devoting our efforts to national defense—stop—we work in military hospitals striving for most effective methods curing wounds so as permit our gallant soldiers to return to ranks as expeditiously as possible also on measures against wartime infections and the like—stop—ultimate aim of all our efforts is earliest and complete annihilation of Hitlerism and emancipation of nations from shameful slavery into which they have been plunged by Hitler and his clique—stop—we do not doubt that this is also your aim today and to that extent our thoughts are one and we may stretch out to each other hand of fellowship."

(Signed) Academician A. I. Abrikosov.

NOTICE TO REGISTERED TECHNICIANS

It may be that the manufacture of the official pin of the American Registry of Physical Therapy Technicians will be stopped for the duration. The firm who make the pin has asked that a future order to cover the anticipated need for the duration be placed at this time. We are reluctant to place a large order. Therefore if you plan to have this emblem and especially if you want this for Christmas gift purposes, please place your order as soon as possible. Further information may be found on page 579 this issue.

BOOK REVIEWS

THE NATIONAL NUTRITION. By *Morris Fishbein*, M.D., Editor of The Journal of the American Medical Association and Hygeia, The Health Magazine. Pp. 192. Price $1.75. Indianapolis and New York: The Bobbs-Merrill Company, 1942.

In spite of the great amount of publicity given to nutritional problems through the various avenues of public information, the author of this work feels that there are still many important facts about food which the average layman does not know. He has, therefore, written the present volume in an endeavor to present the science of nutrition in a comprehensive manner and in language which the layman can understand.

The author differentiates hollow and hidden hunger. The former is quantitative while the latter qualitative. Signs of deficiency states in children and adults are enumerated and balanced daily menus are given. There is a concise but fairly complete discussion of essential food materials with their common sources. The family food supply is presented from the nutritional and the economic standpoints. A chapter on vitamin facts and follies contains information on the function of the vitamins in the human physiology and warns against commercial exploitation. There are chapters on weight control and vegetarianism. There is an important discussion of diseases caused by foods such as food allergy and food poisoning. The final chapter deals with the relation of the food supply to the war in some European countries, as well as our own. The book is spiced with occasional bits of humor for which the author is well known.

STANDARD NOMENCLATURE OF DISEASE AND STANDARD NOMENCLATURE OF OPERATIONS. Edited by *Edwin P. Jordan*, M.D. Limp Leather. Price, $4.00. Pp. 1022. Thumb Indexed. Chicago: American Medical Association, 1942.

The purpose of the system of classifying disease employed in this book is to present a logical clinical nomenclature. The work on this Nomenclature was initiated by invitation of the New York Academy of Medicine, March 22, 1928, and at that time the National Conference on Nomenclature of Disease was formed with a membership representing most of the leading medical and public health organizations in the country. The Commonwealth Fund was responsible for a large share of the financial support for this undertaking. Several editions appeared and the responsibility for the periodic revision was taken over by the American Medical Association in 1937. A fourth National Conference on Medical Nomenclature was held under the auspices of the American Medical Association on March 1, 1940, with Dr. Haven Emerson serving as Chairman. In the interim between similar conferences the work of the Nomenclature is to be done under the direction of the editor and an editorial advisory board consisting of Dr. Dana W. Atchley, Dr. George Baehr, Dr. Bowman C. Crowell, Dr. Neil A. Dayton, Dr. Holbert L. Dunn, Dr. James R. Miller and Dr. Christopher G. Parnall.

This volume represents a complete revision of the volume originally published in 1932 and includes every disease which is clinically recognizable and avoids repetition and overlapping. English terms in good usage are used whenever possible in preference to Latin or Greek terms, although numerous exceptions occur, especially under diseases of the skin and of the eye. This Nomenclature attempts to make clear the distinction between a disease and its manifestations. It is designed primarly for clinicians since the clinical diagnosis is the source of all information on the prevalence and distribution of disease. This book should be in the possession of every physician who keeps a record of his cases. It is an indispensible book for hospital record librarians and editors.

THE CARE OF THE AGED (Geriatrics). By *Malford W. Thewlis*, M.D., Attending Specialist, General Medicine, United States Public Health Hospitals, New York City; Attending Physician, South County Hospital, Wakefield, R. I.; Special Consultant, Rhode Island Department of Public Health. Third Edition. Cloth. Pp. 579. Fifty illustrations. Price, $6.00. St. Louis: The C. V. Mosby Company, 1941.

Seventeen years have elapsed since the second edition of this work; the third edition, therefore, has been entirely rewritten. The author points out that the need for geriatrics has increased in recent years due to the increasing proportion of the population who reach the age of 60 years. The term geriatrics was first used by Nascher in 1909. Relatively little has been written on the medical care of the aged, and the profession in general is neither interested in them nor qualified to treat them. The writer points out that the physician must remember that aging is a normal process and that in caring for the aged, he must not expect to restore the patient nor his organs to the state of his younger years.

The book is divided into five sections. An interesting chapter in section I is entitled "Value of Old Age." Here the author enumerates the achievements of many famous persons who have accomplished some of their greatest work in advanced years. Other chapters in this section are on: hygiene, prevention of premature senility, prolonging life, work for the aged, hobbies, economic problems of old age and medicolegal relations. Important

chapters in section II are: diagnostic errors, nutrition in old age, senile malingering, nursing the aged patient and therapeutics. The infectious diseases discussed in section III are presented very briefly from the standpoint of their occurrence and characteristics in the aged. In section IV the subjects of allergy, alcoholism and focal infection are briefly discussed. Section V occupies over half the volume and presents the pathologic conditions of old age classified by systems; cardiovascular, respiratory, genitourinary, alimentary, endocrine, blood-forming organs, special senses, muscles, bones and joints, neurological, skin and metabolic diseases. There are special short chapters on cancer and on surgery in the aged. The book appears to the reviewer to be a well balanced presentation of the subject of geriatrics with emphasis properly placed on the degenerative conditions of later life. The author shows deep sympathy for these patients who are often neglected both by relatives and physicians. Every physician, who has aged patients under his professional care, should possess this book.

MANUAL OF STANDARD PRACTICE OF PLASTIC AND MAXILLOFACIAL SURGERY. Military Surgical Manuals, Volume I. Prepared and Edited by the Subcommittee on Plastic and Maxillofacial Surgery of the Committee on Surgery of the Division of Medical Sciences of the National Research Council and Representatives of the Medical Department of the U. S. Army. Cloth. Pp. 432 with 259 illustrations. Price, $5.00. Philadelphia: W. B. Saunders Co., 1942.

This is volume one of a series of military surgical manuals. The editors of volume one are Robert H. Ivy, chairman; John Staige Davis, Joseph D. Eby, P. C. Lowery, Ferris Smith, Leigh C. Fairbank, and Roy A. Stout. John Scudder, and Frederick P. Haugen contributed to the volume. Section one considers reconstructive surgery with chapters on cheiloplasty, meloplasty, rhinoplasty, blepharoplasty, otoplasty, defects of the scalp and cranium, cervicoplasty, loss of hard palate and premaxillary portion of the alveolar process. Maxillary surgery is discussed in the second section describing gunshot wounds involving the jaws and fractures of the jaws. Section three describes maxillofacial prosthesis and section four, anesthetic technics, local and general. The volume presents in compact form essential up-to-date data and reliable information concerning plastic and maxillofacial surgery in the military service.

OPHTHALMOLOGY AND OTOLARYNGOLOGY. Military Surgical Manuals, Volume II. Prepared and Edited by the Subcommittee on Ophthalmology and Otolaryngology of the Committee on Surgery of the Division of Medical Sciences of the National Research Council. Cloth. Pp. 331 with 51 illustrations. Price $4.00. Philadelphia: W. B. Saunders Co., 1942.

The first part of the volume on ophthalmology was prepared and edited by the Subcommittee on Ophthalmology, Harry S. Gradle, Chairman, William L. Benedict, S. R. Gifford, Peter C. Kronfeld, Lawrence T. Post, with contributions by William F. Hughes, Jr., and Allan C. Woods. This compendium is not intended to be a treatise on ophthalmology, nor is it designed for the experienced ophthalmologist. In an emergency there is not always available an ophthalmologist to handle every ocular need. The burden of this care, particularly if there is a sudden and unexpected attack, falls on nonspecialists; for them, this manual is intended. Only the simplest treatment is outlined, and the didactic method is followed for the sake of brevity and explicitness. Only the simplest instruments and technics are given. Instruments that would obviously not be available to the general practitioner are not described. The second section on otolaryngology is prepared and edited by the Subcommittee on Otolaryngology: Harris P. Mosher, Chairman, George M. Coates, Ralph A. Fenton, William E. Grove, Frederick T. Hill, Charles J. Imperatori, V. H. Kazanjian, Samuel J. Kopetzky, Harold I. Lillie, John J. Shea, Burt R. Shurly and William P. Wherry. There are contributions by Gordon Berry, C. C. Bunch, Alexander S. Macmillan, and Henau W. Loeb. This section discusses the primary treatment of gunshot wounds of the face, the ear in general, fractures of the temporal bone and of the cribriform plate, injuries to the labyrinth and labyrinthine function, group testing of hearing, malingering, roentgenologic diagnosis of petrositis, petrositis, the ear in military aviation, reeducation of the deafened soldier, reeducation for speech defects, the nose and throat in general, paralysis in connection with wounds of the throat, infections of the throat, chemotherapy, injuries of the esophagus and injuries of the larynx, hyoid bone and trachea. The number of contributors give the reader the advantage of the judgments of more than one author. This is not a textbook but gives a compact presentation of the necessary information in the field of military surgery in ophthalmology and otolaryngology.

ABDOMINAL AND GENITO-URINARY INJURIES. Military Surgical Manuals, Volume III. Prepared under the Auspices of the Committee on Surgery of the Division of Medical Sciences of the National Research Council. Cloth. Pp. 243 with 79 illustrations. Price, $3.00. Philadelphia: W. B. Saunders Co., 1942.

The first part of this volume on abdominal injuries was prepared by Ambrose H. Storek under the auspices of the Committee on Surgery with Evarts A. Graham as chairman and the following members: Irvin Abell, George E. Bennett, Frederick A. Coller, Herman L. Kretschmer, Howard C. Naffziger, I. S. Ravdin, Donald C. Balfour, Warren H. Cole, Robert H. Ivy, Charles G. Mixter, Alton Ochsner and Allen O. Whipple. Abdominal injuries have always been among the most serious casualties of war. Their successful treatment not only demands judgment and technical skill on the part of the surgeon, but is dependent on thoroughly coordinated medical and military organizations. The first part

of the volume describes the recent advances in the care of abdominal injuries in modern warfare discussing the selection of patients for operation, anesthesia, operative procedure, postoperative treatment, complications and results. The second part on genito-urinary injuries was prepared by the Subcommittee on Urology of the National Research Council with Herman L. Kretschmer as chairman and the following members: William F. Braasch, Homer G. Hamer, Frank Hinman, Oswald S. Lowsley and Albert J. Scholl. There are also contributions by Clark M. Johnson and H. M. Weyrauch. This section considers the diagnosis of war injuries of the genito-urinary tract in general; injuries of the kidney and ureter; war injuries of the bladder; care of the neurogenic bladder; injuries of the penis and urethra, of scrotum and contents; of the prostrate gland and seminal vesicles. There is a final chapter on "do's" and "don'ts." Every chapter in this volume is by a recognized authority. These monographs should be in the library of every physician whether in the armed forces or in civilian practice.

THE ART OF SELF-CONTROL. How to Make Your Habits Work for You. By *Ralph A. Habas.* Cloth. Pp. 284. Price, $2.00. New York: Reynal & Hitchcock, 1941.

Written in popular style the author first reviews experiments whereby healthy, normal animals were made to become neurotic and antisocial. This is to show that we must not let ourselves be driven like the experimental animals were to make decisions that we are unequipped to make. Many examples involving the names of well known persons are cited to show how success is not as a rule an accident but because of a carefully thought out plan and a determined desire and conscious effort to "hew to the line." Many points are stressed by the use of italics. For example "Anger is costly" and what to do to avoid becoming angry. "Avoidable relapses should never be allowed," and we should "think realistically and act sensibly." In reading through these suggestions one can scarcely avoid the conclusion that most of us do not stop to think much about ourselves especially as to what we want and why. Much, then, can be gleaned of aid to anyone who reads about this ever interesting subject.

AMERICAN SURGEON ABROAD. By *Richard A. Leonardo,* M.D., Ch.M., F.I.C.S. Cloth. Pp. 235 with 20 plates. Price, $2.50. New York: The Froben Press, 1942.

This is a narrative of the observations of a second generation American, a physician, who went to Europe in search of postgraduate work in surgery. He proudly relates that his father was the proprietor of a successful spaghetti restaurant at Rochester, N. Y., and managed to educate two sons as lawyers and one as a physician. This physician, who also became coroner at Rochester, is the author. It is natural that he should first go to his ancestral Italy and enjoy its many sights; he relates these and the history of the renowned medical schools of Italy. He then proceeds to Austria, describes some of the scenic beauties and then the postgraduate work which he was able to do through the well organized American Medical Association of Vienna. Next he discovers the exceptional opportuntities for living surgery at Budapest and other Hungarian cities—due to postwar economic stress of the leading medical men there—and he waxes enthusiastic over the spirit and hospitality of the Hungarians and the unique sights of that land. He liked the experiences of his first stay from 1924 to 1926 so much that he returned four times until 1939. On these visits he saw Germany, Great Britain, France and some of the smaller countries. The account of these sights rounds out the volume as an interesting record of frank impressions of European clinics in the period between the two World Wars. Portraits of some of the outstanding surgeons and of some of the historically interesting spots add to the picturesqueness of the presentation. The author is convinced that after this war American physicians will be more welcome than ever for postgraduate work in Europe and will enjoy the same exceptional opportunities he had for cadaver and living surgery. However, it is hard to foretell what kind of a Europe there will be after the present holocaust, for even at this time, many of the medical men portrayed have been purged and many of the famous institutions closed or blasted.

MEDICAL MANUAL OF CHEMICAL WARFARE. Revised Edition. Cloth. Pp. 121. Several illustrations and plates. Price, $2.50. Brooklyn: Chemical Publishing Company, Inc., 1942.

This timely little volume is published primarily for the use of the medical officers in the various armed services. It is a well prepared and well planned compend of information regarding the various gases which have been and may yet be used in warfare. It is not a textbook on the chemistry of gases; nor is it simply a therapeutic handbook. It abstracts the essential properties and characteristics of each gas, and gives the symptoms, pathology and treatment of the effects of exposure to the various gases. Each gas is considered, first in a general classification of gases, then as to its specific classification as a vesicant, irritant, paralysant or harassing gas. Also taken into account are the various dangerous gases not used for offensive purposes, but which may often be encountered in warfare. Protection against gases and first aid after exposure is explained clearly. There are three appendices, dealing with a summation of the gases, the administration of oxygen and a reproduction of the "Atlas of Gas Poisoning," published by His Majesty's Stationery Office. The latter appendix is illustrated with ten plate drawings showing the effects of the various gases. These drawings, while carefully done, cannot bring out the clinical features very clearly. This small volume amply fulfills its object, "to present briefly a resume of the effects of chemical warfare substances and the methods that should be adopted to minimize them."

DISABILITY EVALUATION. PRINCIPLES OF TREATMENT OF COMPENSIBLE INJURIES. By *Earl C. McBride,* B.S., M.D., F.A.C.S., Assistant Professor in Orthopedic Surgery, University of Oklahoma School of Medicine; Attending Orthopedic Surgeon to St. Anthony's Hospital; Associate Orthopedic Surgeon to Wesley Hospital; Visiting Surgeon to W. J. Bryan School of Crippled Children; Chief of Staff to Bone and Joint Hospital, Oklahoma City, Okla. Third Edition, Revised. Cloth. Pp. 600 with 375 illustrations. Price, $9.00. Philadelphia: J. B. Lippincott Company, 1942.

Disability is a term that implies a transformation of body structures which results in a depreciation of normal ability to perform the functions of established physical accomplishments. It may result from injury, disease, new growth or malformation. The period of existence may be temporary, progressive or permanent. Constant adjustment of body structures through reflex and voluntary stimuli is necessary to create the mental and physical activities of life. Sudden interruption of the normal body functions through disease or injury calls for a new role of the neuromuscular and emotional mechanism. This book interprets the physiologic and mechanical alterations arising out of injury to the motor structures of the human body. It gives methods by which reasonably to appraise and evaluate the extent of functional loss as it relates to the economic incapacity of the injured. According to Workmen's Compensation Laws it is often demanded that the surgeon appraise and evaluate the difference between the person as he was before his injury and the variation from normal after recovery. There is asked the extent of his disability in terms of percentage loss of the use of the body. Guessing casts reflection on the integrity and qualifications of the surgeon. Too many Workmen's Compensation Boards have a poor opinion of the medical profession through repeatedly hearing expressed wide difference of medical opinions on the same case.

The author offers a uniform system of arriving at percentage conclusions of loss of use. He does this by stressing the effects of physiologic and mechanical alterations of the motor parts of the body and drawing conclusions as to the loss of function by evaluating the factors which compose function. Thoroughly revised, this is the third edition since 1936 which shows that it has been successful. It should be in the library of every surgeon who treats injured workmen.

WAR MEDICINE. A SYMPOSIUM. Editor, *Winfield Scott Pugh,* M.D., Commander (M.C.), U. S. N. Retired. Formerly Surgeon, City Hospital, New York; Associate Editor, Edward Podolsky, M.D.; Technical Editor Dagobert D. Runes, Ph. D. Cloth. Pp. 565 with illustrations. Price, $7.50. New York: Philosophical Library, Inc., 1942.

This is a series of articles originally published in medical journals, such as *The Military Surgeon, The British Medical Journal, The American Journal of Surgery* and a dozen of others. These articles all relate to the war and have been arranged in three main groups: Surgery, Aviation and Naval Medicine and General Medicine. Many of the contributors are with the armed forces of the United States and Great Britain and many of the articles are of great intrinsic value, although little seems to have been done in the way of editorial organization. A few articles are illustrated, some have no bibliography, others have an abundance of it. There is no index. This symposium offers much timely and interesting information.

ELECTROPHORESIS OF PROTEINS AND THE CHEMISTRY OF CELL SURFACES. By *Harold A. Abramson,* Assistant Professor of Physiology, College of Physicians and Surgeons, Columbia University; Associate in Medicine, The Mount Sinai Hospital, New York; *Laurence S. Moyer,* Assistant Professor of Botany, University of Minnesota, Minneapolis and *Manuel H. Gorin,* Chemical Research Supervisor, Field Research Department, Magnolia Petroleum Company, Dallas, Texas. Cloth. Pp. 341 with 155 illustrations. Price $6.00. New York: Reinhold Publishing Corporation, 1942.

In the past decade there occurred a renaissance of electrophoresis not only in the realm of physical therapy but also in the field of biological science, by applying electrophoresis for the investigation of surface chemistry. An unusual combination of students, the first a physiologist and clinician, the second a botanist and the third a research chemist combined to investigate by means of electrophoresis the behavior of proteins in solution and on surfaces and reversely tested the theories of electrokinetics and conductance. Much of this research was carried out under grants from the Josiah Macy Jr., Foundation and from the Graduate School of the University of Minnesota. The result is the present volume which should be of inestimable value in the further investigation of surface chemistry of living cells. The first six chapters provide the theoretical basis of the discussion, presenting the general principles of electric migration in liquids, experiments, methods and a discussion of dissolved and adsorbed proteins and related surfaces, the electrokinetic theory and migration of charged particles and electric mobility and finally, calculation of the net charge. All of this is of course highly theoretical and mathematical. The second, more descriptive half of the volume outlines the present knowledge about the connections of the proteins to their biological functions under such successive chapter-titles as serum and plasma, antibodies and antigens and their reactions, interactions of proteins in mixtures and at surfaces, enzymes and hormones, miscellaneous electrophoretic investigations of biological interest and surface chemistry of cells. The therapeutic applications of electrophoresis along which one of the authors, Abramson has done some outstanding work, are discussed in the last chapter. This is a profoundly scientific and stimulating book, which bears promise of further pathfinding studies by its authors. It is a real tragedy that as the volume went to press, Dr. Moyer was killed in the service of his country.

GRAY'S ANATOMY. Anatomy of the Human Body. By *Henry Gray*, F.R.S. Thoroughly Revised and Re-Edited by *Warren H. Lewis*, B.S., M.D. The Wistar Institute of Anatomy and Biology, Philadelphia, Penna. Associate Editors: *Earl T. Engle*, Ph.D., Columbia University, College of Physicians and Surgeons, New York, N. Y.; *Joseph C. Hinsey*, Ph.D., Cornell University Medical College, New York, N. Y.; *Normand L. Hoerr*, Ph.D., M.D., Western Reserve University, Cleveland, O.; *Karl L. Mason*, Ph.D., University of Rochester, Rochester, N. Y.; *David McK. Rioch*, M.D., Washington University, St. Louis, Mo., and *Roy G. Williams*, M.D., University of Pennsylvania, Philadelphia, Pa. Twenty-fourth Edition. Cloth. Pp. 1428, illustrated with 1256 engravings, mostly in colors. Price, $12.00. Phialdelphia: Lea & Febiger, 1942.

This classic work is too familiar to need a detailed review. The assistant editors are well known in their fields and have added their authority to make this twenty-fourth edition a compilation of the latest information without discarding the familiar arrangement of chapters and subject matter that has characterized the work for so many years. Many new illustrations have been added and the introduction of thirty roentgenograms to the section on Surface and Topographical Anatomy is a recognition of the important role roentgenography now plays in anatomy as well as in medicine and surgery. Its effectiveness as a text for medical students and its practical value to the physician or surgeon as a reference work in daily practice recommend it without reservation.

PHYSICS. By *Frank L. Robeson*, Professor of Physics, Virginia Polytechnic Institute. Cloth. Pp. 820. Illustrated. Price, $4.50. New York: The Macmillan Co., 1942.

In many instances, classes in general physics are composed of students who have had no previous training in the subject, as well as of those who have had an introductory course. The treatment of the subject matter is designed to meet the requirements of both groups. In so far as possible the use of mathematics has been limited. Historical sidelights are interspersed to maintain the chronologic perspective and to make the reading "more palatable." Many footnotes indicate where fuller discussions may be found. The contents consist of 48 chapters, an appendix and an index. In addition to the introduction the material in these chapters is divided into sections on mechanics, heat, electricity and magnetism, electrodynamics and light. The chapters on electrophysics should be helpful to those interested in physical therapy. The arrangement and manner in which the material is organized make it a book highly recommended to those who do not need an elementary text on physics.

POSTURE AND NURSING. By *Jessie L. Stevenson*, R. N., Consultant in Orthopedic Nursing, National Organization for Public Health nursing. Paper. Pp. 63. Price on application. New York: Joint Orthopedic Nursing Advisory Service of The National Organization for Public Health Nursing and the National League of Nursing Education, 1942.

There will always be a demand for small, paper-backed, relatively inexpensive monographs. This latest monograph on posture and postural instruction was written primarily for nurses to assist them in maintaining correct posture themselves and also for use as a text and guide for teaching posture to the various patients. Many sections are shorter than they might be if this were to be considered as a textbook. This, however, does not in any way detract from its value. Posture, body mechanics and functional anatomy are briefly but adequately explained in the first part. The second part of the book gives the application of these basic principles to the nurse and her patients. This includes instructions for the expectant mother and for children from cradle age through school. Postural instruction for school children is extremely important and more stress could be laid on this. There is a good section on the care of the person suffering from a general illness. The booklet is well illustrated by 36 photographs showing correct and incorrect positions of posture. There are numerous line drawings illustrating various types of movement of the different joints. The monograph is one of a series planned in relation to orthopedic nursing. It has been well written and should excellently serve its purpose.

PHYSICAL THERAPY ABSTRACTS

The Effect of Exercise and of Four Commonly Used Drugs on the Normal Human Electrocardiogram, With Particular Reference to T Wave Changes. Alfred S. Hartwell; John B. Burrett; Ashton Graybiel and Paul D. White.

J. Clin. Investigation **21**:409 (July) 1942.

Many factors, aside from heart disease, may affect the electrocardiogram and is a matter of importance for anyone making electrocardiographic interpretations. It becomes significant in those instances when the electrocardiogram is on the borderline of normality, or in an attempt to evaluate the successive changes in electrocardiograms taken serially.

It is the T waves of the electrocardiogram which are most commonly and significantly affected by these extracardiac factors.

Exercise lowers the T waves of the normal human electrocardiogram with return toward normal in less than a minute. During recovery the amplitude of T may be greater than normal. Adrenaline lowers the T waves. The effect lasts from fifteen to thirty minutes. Ergotamine tartrate raises the T waves. This effect lasts as long as an hour. Atropine lowers the T waves. The effect is maximal in one hour but may last ninety minutes. Mecholyl lowers the T waves and causes tachycardia without preliminary bradycardia. Right carotid sinus pressure causes an elevation of the T waves. The importance of taking these changes into account when interpreting electrocardiograms is stressed.

The Effect of External Temperature on the Course of Infectious Myxomatosis of Rabbits. R. F. Parker, and R. L. Thompson.

J. Exper. Med. **75**:567 (June) 1942.

It has been shown by one of us that exposure of rabbits continuously to a high external temperature modifies markedly the course of infectious myxomatosis. The experiments here reported were undertaken in a continuation of these observations and were designed to measure more exactly the effect of external temperature on the course of infectious myxomatosis and to obtain information as to the reaction of animals convalescent from infection when they were subjected to reinoculation with active virus.

Rabbits, convalescent from vaccinia and in good general health, were subjected to infection with myxoma during a period of exposure to a high external temperature. It was observed that in proportion as the temperature was elevated, a profound change in the course of the myxoma infection occurred. At the highest temperatures, the disease was held completely in abeyance, and no lesions appeared within seventeen days of observation. At lower temperatures lesions appeared which tended to be circumscribed and which reached their maximum development within six to eight days after inoculation. Regression then set in and complete healing occurred. There was wide variation in the degree of protection which a given temperature conferred on an individual rabbit as measured by the amount of virus required to cause infection, although for single animals the difference in concentration of virus required to produce consistently positive and consistently negative results was not apparently different from that obtaining in the controls. With the data at hand, it does not appear justifiable to draw final conclusions as to the state of immunity of the animals which survived the modified infection.

The Treatment of Syphilitic Primary Optic Atrophy. Joseph Earle Moore; Richard D. Hahn; Alan C. Woods, and Louise Sloan.

Am. J. Ophth. **25**:777 (July) 1942.

The conclusions of the authors are:

Syphilitic primary optic atrophy occurs most frequently in association with tabes dorsalis, although together with pupillary changes, it not infrequently may constitute the only clinical evidence of neurosyphilis. It is probable that the fundamental process is the same in all types of neurosyphilis.

The course of the untreated disease is extremely variable. The process almost always becomes bilateral soon after onset and 90 per cent of untreated patients are blind within twelve years.

Data suggests that the development of syphilitic primary optic atrophy can be prevented by the adequate routine treatment of early syphilis.

Routine therapy with the trivalent arsenicals and bismuth is of no value in the treatment of syphilitic primary optic atrophy.

Subdural treatment by the Seift-Ellis technic should be abandoned. Its dubious value in an occasional patient is outweighed by a risk of sudden loss of vision in about 10 per cent of those treated.

Fever therapy is an efficient method of treatment. If visual failure progresses in spite of fever therapy, no other form of therapy is likely to be of value. The authors emphasize that these conclusions are subject to specific limitations imposed by the material on which the study is based. Since malaria therapy was not given to patients with a rapidly progressive type of disease, no statement is permissible as to its efficacy. It is certain that many of the untreated and routinely treated patients would not have been benefited by any treatment; in many there was literally no time for treatment. The fact remains that when there is time for treatment, malaria is of definite

practical value. Whereas early diagnosis is often possible only by routine determination of the visual fields, fundi, and visual acuity, this procedure is recommended as a routine supplement to the clinical and laboratory examinations in all patients with neurosyphilis.

Inductotherm Treatment of Sulphapyridine Anuria. John M. Rogan, and Eric K. Cruickshank.

Brit. M. J. **4250**:757 (June 20) 1942.

Disturbance of renal function developing during treatment with the sulphonamide series of drugs has been described by various authors. Clinically this disturbance may range from transient hematuria to anuria with resulting death from uremia.

Prominent in the consideration of the treatment of a certain patient was the assumption that the renal tubules were blocked with sulphapyridine crystals. With the aim of promoting active hyperemia of the glomeruli and increasing secretion it was decided to employ inductotherm (short wave) treatment. This method of heating deep tissues has been applied previously in cases of renal disease (Stark, 1939), but the authors were unable to find any reference to its employment in anuria resulting from the use of the sulphoamide group of drugs. The results indicate that it may be of considerable value in the treatment of cases in which the condition is due primarily to mechanical obstruction of the renal tubules. It is unlikely that this treatment would be equally effective when glomerular damage is present.

It would appear that in cases with oliguria or anuria arising from the use of the sulphonamides this method of treatment is worthy of trial before submitting the patient to ureteric catheterization and lavage of the renal pelves, a procedure which may be inadvisable when an infection of the urinary tract is present. Catheterization will of course be required when the ureteric lumen is completely occluded.

The roentgenographic observations in this case indicated the presence of intrarenal changes, gradually diminishing during convalescence. It is therefore apparent that, even though ureteric catherization may have to be carried out, short wave therapy may be a useful adjunct in clearing the renal tubules to the greatest extent at the earliest opportunity.

A New Bipolar Spot Coagulating Electrode for Neuro and General Surgery. Mark Albert Glaser.

Western J. Surg., Obst. & Gynec. **50**:171 (March) 1942.

The use of a coagulating electrode has expedited the performance of neurosurgical procedures because the blood vessels situated deeply in the soft brain can readily be coagulated. By the use of the bipolar electrode coagulation is limited to the spot between the two points of contact. There is little, if any, burning around the edges and a minimum amount of coagulation.

Clinical Chemistry. Plasma Proteins in Therapeutic Fever. Israel Kopp.

J. Lab. & Clin. Med. **27**:1054 (May) 1942.

Intravenous malarial inoculation was followed in 7 of 8 patients by a slight or a marked and rapid fall in albumin during the incubation period and before any fever occurred.

Only slight fluctuations in albumin, ranging from a fall of 9 per cent to an increase of 13 per cent, occurred in 2 patients to whom 11 and 16 bouts of typhoid vaccine fever were administered over periods of twenty-four and thirty-nine days, respectively.

Repeated administration of artificial fever resulted in only a slight reduction of the albumin, the maximum fall being 13 per cent below the prefebrile level. The final value, however, after a course of 14 treatments over a thirty-eight-day period, differed only little from that before treatment. The changes in globulin fluctuated equally, about 12 per cent, in both directions. Fibrinogen values during therapy tended to fall as much as 30 per cent below prefebrile levels but remained within normal limits. Three weeks after therapy was terminated the patient was inoculated with tertian malaria and experienced a 30 per cent reduction in albumin as a result of malarial fever.

Fever produced by inoculation malaria results in marked changes in the plasma proteins consisting of a rapid and marked drop in albumin and fluctuations in globulin and fibrinogen. Termination of malarial fever by quinine is followed by a rapid return to normal values. Fever produced by typhoid vaccine and artificial means (inductotherm) causes only slight fluctuations in the plasma protein fractions. The more marked reduction in albumin during malaria may be due in part to the greater amount and the more rapid recurrence of fever. The infectious process per se present in malaria is probably the most important factor interfering with the synthesis of albumin in the liver even though dietary intake appears adequate. The increases in globulin are greater during malaria than during fever induced by typhoid vaccine or artificial means. The presence of an infectious process and the destruction of red blood cells during malaria account for the greater increases in globulin. Fibrinogen is increased during malaria and typhoid vaccine fever. The progressive fall in fibrinogen, which occasionally occurs during malaria, indicates probable liver damage.

Facial Patterns of Electrical Skin Resistance. Curt P. Richter and Bettye G. Woodruff.

Bull. Johns Hopkins Hosp. **70**:442 (May) 1942.

The skin on the faces of 42 normal young adults showed a sharply demarcated area of low electrical resistance which usually included both eyelids, the nose, the mouth, as well as varying portions of the forehead, of the cheeks and of the skin under the lower lip. The pattern of the area of low skin resistance was essentially constant for each person under constant conditions of temperature. During sleep in both infants and adults the area became constricted, finally including only

the mouth. On awakening the area quickly dilated to the normal size. During the various stages between deep sleep and waking the pattern formed concentric zones around the mouth. In warm external temperatures the area of low electrical resistance dilated until in some instances it included all of the head. In cold temperatures the area became constricted until it included only the mouth and lips. Here again the pattern at the different body temperatures formed concentric zones around the mouth. It was shown that the facial area of low resistance closely resembled the pattern of the hairless areas of the faces of apes and many monkeys. It coincides only in part with the hair line found in man. In bald-headed men the area of low electrical resistance included all of the bald area of skin up to within 1 inch of the line of the remaining hair.

The patterns of low electrical skin resistance showed a close correlation with the patterns of areas of remaining pain and temperature sensitivity found in patients with syringomyelia and syringobulbia. Both form concentric zones around the mouth and in different stages have almost identically the same shape. Since the segmental patterns of remaining sensitivity apparently depend on the affected segments of the descending spinal nucleus of the trigeminal nerve, it was pointed out that the low skin resistance pattern may also depend on segmental changes in this nucleus. It was indicated that the skin resistance patterns might help to give a measure of activity of the sympathetic nervous system.

It was further pointed out that the low resistance of the area indicated high metabolic activity which agrees with results of other workers who reported that the head end of all organisms shows the greatest metabolic activity.

Attention was drawn to the fact that the facial area with the low electrical resistance and the high metabolic activity shows the highest incidence of skin cancer.

An Apparatus for Resuscitation of Newborn Infants. Leonard H. Biskind, and Eduard Eichner.

Am. J. Obst. & Gynec. **44**:147 (July) 1942.

The Dann resuscitator is a safe, efficient, positive pressure respirator. It is simple and virtually foolproof in design, having only two controls. The rate and volume of respiration are independently adjusted to the physiologic needs of the infant. Once adjusted the machine is entirely automatic. Its rhythmic, gentle insufflations simulate natural respiration. Exhalation occurs spontaneously. The attached aspirator may be used before full delivery of the infant and should always be used before starting resuscitation. In use, it may be readily alternated with the resuscitator. The simplicity of this machine makes it easily operated by almost anyone.

Perineuritis. James Cyriax.

Brit. M. J. **4244**:578 (May 9) 1942.

First employed as a method of corroborating a diagnosis, local anaesthesia was soon found by experience to be an excellent method of treatment of perineuritis. When the pain due to the return of perception to the nerve sheath had worn off, marked symptomatic improvement was reported in almost every case.

Direct action of the procaine on the nerve sheath appears to be the way relief is obtained. Alternatively, distension with fluid of the space between the nerve and the tissues round it might be responsible. If this were so, the effect would presumably be obtained by separation of adhesions about the sheath by hydraulic pressure. In the sciatic nerve this object would also be attained by stretching under general anesthesia; but this procedure makes the patient much worse in acute or subacute sciatic perineuritis. Since mobilization of the nerve is not responsible, the view that procaine initiates a lasting effect on nerve sheaths is the more probable hypothesis. In the author's experience no treatment other than the induction of local anesthesia of the nerve sheath is effective. Heat has proved valueless and massage harmful.

The Treatment of Depression in Later Life. Dalton E. Sands, and William Sargant.

Brit. M. J. **4242**:520 (April 25) 1942.

The results of the authors work confirm the observations of American workers that convulsion therapy is at present the most effective treatment available for depression in later life. High percentages of remissions in good previous personalities may be expected. Complications do not outweigh benefits to be obtained in any large group of cases, if reasonable clinical skill is exercised and every possible measure is used to avoid them. The full application of this treatment all over Britain would result in large numbers, amounting to thousands, of patients being able to leave mental hospitals or resume a reasonable degree of working efficiency without prolonged invalidism. It seems urgently demanded in the present emergency, since a physician, using electrical methods and working only two hours a day, can treat over 50 uncomplicated cases in a week.

The Photosensitivity of Visual Purple Solutions and the Scotopic Sensitivity of the Eye in the Ultraviolet. C. F. Goodeve; R. J. Lythgoe and E. E. Schneider.

Proc. Roy. Soc. Med. **130**:861 (May) 1942.

The relation between the rate of bleaching of visual purple solutions by visible light and the sensitivity of the eye in the dark-adapted state (scotopic vision) has been described in a previous paper (Schneider, Goodeve and Lythgoe 1939). The rate of bleaching at any particular wavelength is governed by the photosensitivity, i.e. the product of the extinction coefficient α and the quantum efficiency γ.

Hosoya (1937) found that visual purple was sensitive to ultraviolet light of wavelengths 3650, 3130, 3020 and 2970 angstrom units. He measured the absorption as the visual purple was

bleached and with wavelengths 3650, 3130 and 3020 angstrom units the optical density increased with time of illumination.

From the experiments described in the previous section it appears that light of any wavelength down to 2540 angstroms causes the same photochemical change in visual purple and therefore one would expect the retina to be sensitive to this range of ultraviolet light. It is known, however, that there is a sharp limit of vision between 3020 and 3130 angstroms (Goodeve, 1934) which has been attributed to the absorption of the crystalline lens. Preliminary experiments showed that the relative sensitivity of the eye to 3650 angstrom was much less than would be expected from the photosensitivity of visual purple at this wavelength. Experiments were therefore undertaken to obtain quantitative information. The interest of these measurements was greatly extended by the observation of Gaydon (1938) that aphakic eyes are much more sensitive to ultraviolet than ordinary eyes.

Both chromatic and scotopic vision apparently occur throughout the range of "visible" ultraviolet light and the mechanism of vision appears to be the same as for ordinary visible light. At high intensities the ultraviolet light has color, which is described by various observers as violet, blue, lavender grey, etc. As the intensity is reduced the color disappears, leaving a grey image, such as is characteristic of scotopic vision at longer wavelengths. A further characteristic of scotopic vision, the increase in sensitivity with time in the dark, is found in the ultraviolet. In the experiments described below the rate of increase of sensitivity with dark adaptation was found to be the same for 5460 as for 3650 angstroms, and the curves in all respects are similar.

Previous determinations (Goodeve, 1934) of the limit of vision in the ultraviolet were made with a mercury-arc lamp as light source and it was found that the 3130 line was visible whereas the 3020 line was not. Vision at 3130 angstroms was apparently quite normal except that the object was in focus when only 4 inches from the eye (see also de Groot, 1934).

The Routine Use of Bicycle Exercises for the Prophylaxis of Postoperative Thrombophlebitis. A Preliminary Report. Joseph M. Krebs.

Am. J. Obst. & Gynec. **44**:73 (July) 1942.

The use of exercise in the prevention of this complication is not a new idea. As early as 1913, Pool suggested the routine employment of systematic exercises in postoperative treatment. His exercises included flexions, extensions, rotations, pronations, supinations, to be carried out at a certain portion of each day under the supervision of nurses. Following their use in a considerable number of patients, he was able to conclude that the general circulation was improved, the functions of the body were performed in more normal manner, the patients felt better, muscular weakness and atrophy were diminished, after getting up exertion was less fatiguing and return to normal was more rapid.

Smith and his associates found that rapid movement of the legs while in the supine position invariable increased the speed of the blood flow. Elevation to an angle of 30 degrees of the extremities of supine subjects invariably decreased the circulation time. This work, reported in 1941, tends to substantiate the results of Pool and other advocates of the value of exercises and elevation, in the prophylaxis of thrombosis.

Dr. A. P. Martini, formerly associated with the department of gynecology and obstetrics of St. Louis University, at the suggestion of the director of the department, Dr. W. H. Vogt, constructed an apparatus as described by Gamble. This machine is designed with the idea of employing routine exercises of the lower extremities in a manner that would require a minimum of supervision by the nursing staff and of preparation of the patient.

The regimen instituted by Dr. Martini was to start the exercises on the first day after the operation. On that day, the exercises were taken twice, for five minutes each time. The patients were instructed, by the nurse in attendance, as to how to fit themselves to the apparatus, and shown about the desired speed of motion. On subsequent days, the exercises were increased to ten minutes twice each day and were continued until the patient was out of bed. Usually no care was needed for the patients during the time of these subsequent exercises.

Of these 209 patients who had bicycle exercises there were none who developed thrombophlebitis after a sufficient course of treatment. One had the exercises for six days and developed phlebitis on her tenth day.

Of 308 patients, in the same period of time, subjected to operation without the advantage of bicycle exercises, five developed thrombophlebitis, an incidence of 1.6 per cent.

Passive Transfer in Light Urticaria. Pathomechanism of Physical Allergy. E. Rajka.

J. Allergy **13**:327 (May) 1942.

A shoemaker, forty-four years of age, has been sensitive to light for eighteen years. In summer and also in winter when exposed to snow and sunshine, the uncovered parts of his body, especially the hands and face, become swollen and red. He then has in addition malaise and dizziness.

Irradiation on the back through the usual fenestrated equipment for from one-fourth to two minutes caused a hyperemia at the end of the second minute. Edema first occurred at the two-minute fenestra but soon, in full accordance with the openings, typical wheals with sharp borders without projections arose at all places surrounded by a confluent hyperemic area.

In a case described by the author a marked though not strong general response was present. After a one-minute irradiation of the whole back which was followed by an edematous swelling of the entire irradiated area, a sensation of heat and weight in the head occurred. There was almost no change in the pulse; the systolic blood

pressure became 10 mm. lower, the temperature was unchanged; the leucocyte count diminished from 7,300 to 6,000; the serum refraction value became 20 units higher; the blood clotting time was three minutes longer; and the complement titer was slightly reduced.

Importance was ascribed to the passive transfer test. In the literature there is no report on a positive Praunitz-Küstner reaction with photogenous urticaria. Only Bernstein in 1933 reported positive transfer to guinea pigs and mice in the form of dermatitis and necrosis. At the site inoculated with the patient's serum, hyperemia appeared with strong itching and then a typical urticaria developed, whereas the place inoculated with the control serum showed no reaction. Both the sera taken before and after irradiation gave positive tests. The results with the latter were more intensive. With urine the transfer did not succeed. It seemed likely that the reagins became partly fixed or, more correctly, inactivated in the patient's serum previously exposed to light. Therefore the transfer was on several occasions made both with irradiated and nonirradiated serum kept in the dark.

The author reports only partial success in specific desensitization. When the wheal had been elicited one day over a rather large area, the same area reacted to a similar dose for the next two to three days with only a hyperemia and at most a minimal nonconfluent edema. Places with pigmentation displayed a lessened sensitivity, e.g., the threshold rate was on the slightly pigmented skin of the forearm from fifteen to thirty-five seconds compared to five seconds, and only hyperemia and follicular edema ensued.

For the sake of comparison twenty-seven cases of light urticaria reported by twenty-two authors have been collected from the literature available. The prevalence of the female sex (seventeen) is striking. This might perhaps be explained by endocrine conditions, as sensitivity to light frequently was increased with menstrual disorders. Noteworthy also is the various duration of the condition ranging from a very short time to many years. Nearly all of the patients reported reacted to the short visible (blue) rays and to the long wave UV rays.

The recently increasing number of passive transfer tests reported in cases of physical allergy should (from the viewpoint of a unitary biologic mechanism) identify physical allery with other allergies.

The following groups belong to the physical allergies: (1) Certain kinds of endogenous itching, urticaria factitia, (2) cold urticaria (cold dermatitis), (3) heat urticaria and heat dermatitis, (4) photogenous urticaria and some dermatitides due to light (eczema solare, prurigo aestivalis). The grouping of these presumably physical processes as allergic takes place on the basis of criteria which are generally liable to prove the allergic nature of a process. These criteria are as follows: (1) Positive dermal test with the specific irritant. The physical stimulus induces in an intensity which causes no inflammation in the normal person. (2) Application of the physical stimulus causes, especially when applied to a large skin surface. (3) Specific desensitization can be effected. The suitable method has been worked out by Lehner and Rajka in which homologous physical irritants are applied with a gradually increasing intensity in connection with injections of autogenous blood. (4) The greatest importance is ascribed to the passive transfer of the reagin, the carrier of specificity.

The Treatment of Arthritis by Electropyrexia Including Some Physiologic Studies During Fever Therapy. S. L. Osborne; D. E. Markson; R. E Driscoll, and J. R. Merriman.

J. Lab. & Clin. Med. **27**:1135 (June) 1942.

Numerous reports have appeared since the original communications of the authors evaluating artificial fever in the treatment of chronic arthritis. Marked differences of opinion exist as to the merits of this therapy. Their study gives the results obtained with electropyrexia in 27 patients suffering from chronic infectious arthritis.

The treatment, given once a week, consisted of four hours of fever between 104 F. and 104.6 F. An effort was made to keep the temperature as close to 104 F. as possible. Each patient received from six to eight treatments. In conclusion the authors point out (1) Twenty-seven patients suffering from chronic infectious arthritis were submitted to a fever of 104 F., maintained for four hours, and induced by electromagnetic induction. (2) Various physiologic observations, such as blood pH, ascorbic acid concentration of the blood, the specific gravity of blood, finger volume changes, total and fractional blood proteins, and blood pressures were reported. (3) Twenty-two per cent of the patients were markedly improved; 22 per cent moderately improved; 33 per cent slightly improved; and 22 per cent unimproved. (4) This form of therapy is not specific for chronic infectious arthritis but should be used in properly selected patients.

The Treatment of Chronic Suppurative Otitis Media. Arthur G. Wells.

Practitioner **148**:888 (June) 1942.

Actinotherapy has found a limited amount of favor. It is used locally by means of irradiation from a water-cooled Kromayer lamp through a quartz rod inserted into the meatus. The author has treated a considerable number of patients by this method and his best results were obtained in post-mastoid-operation cases, mostly radical mastoids, in which the healing process appeared to have slowed up or remained stationary. The use of ultraviolet rays seemed to stimulate the tissues into renewed activity and to hasten healing. It is claimed that the rays are bactericidal to all organisms (but not spores) within twelve seconds and stimulating to the cells and so conducive to healing. The ear should be cleansed thoroughly before irradiation. If general actinotherapy is ad-

ministered as well, the effect of the local application is enhanced.

In view of the apparent benefit in the surgical treatment of wounds by local application of sulphonamide compounds, the author has been experimenting with sulphapyridine and sulphanilamide, both separately and combined, in chronic ear cases. The results have been inconsistent.

Another method of treatment which is frequently useful is the introduction into the meatus of a wick of half-inch plain sterilized ribbon gauze, the deeper end of which is in contact with the tympanum or perforation in the membrane. This acts as a drain and should be removed as often as soiling by the discharge makes it desirable.

The bulk of the discharge and accumulation can be removed mechanically, but there still remains on the surface of the tissues a layer of exudation containing micro-organisms, and also in the tissues, microscopic in depth. The best way to get rid of gross discharge is to apply negative pressure, that is, suction to the ear.

In cases of uncomplicated tympanic sepsis with a small amount of muco-pus or mucoid discharge, insufflation of boric acid powder, or 0.75 or 1.0 per cent iodine in boric acid powder, is a suitable treatment. The powder absorbs the discharge and is a poor culture medium for organisms.

An effective method of treatment for any condition of uncomplicated tympanic sepsis is zinc ionization. Many of these cases require only one administration lasting for ten to fifteen minutes. The author has employed this method of treatment since 1918 in some thousands of cases with consistent results. Lack of success can only be explained by (a) incorrect diagnosis as to the cause of chronicity, (b) defective technic in preparation of the ear, which must be cleansed completely of all debris, or in the actual details of the administration. Reinfection, resulting from colds in the head or getting water into the ear, will occur in some cases at a later date, but this has nothing to do with the treatment, and may occur after an ear has been cleared up by any other method. Apart from the effectiveness of zinc ionization, the amount of saving in time, suffering, inconvenience is important.

Electrostimulated Convulsive Doses in Intact Humans by Means of Unidirectional Currents. Emerick Friedman, and Paul H. Wilcox.

J. Nerv. & Ment. Dis. **96**:56 (July) 1942.

A method and apparatus for delivering various types of unidirectional electrical stimulation were described together with a method for estimating the amounts of current at the time of administration.

Unidirectional wave forms: half-sine, galvanic current pulses, combinations of these two forms and repetitive condenser discharges were administered to 11 hospitalized psychotic patients.

The electrostimulated convulsant dose of these above wave forms was measured in 42 instances.

In 74 per cent of the trials the dose varied between 24.0 and 57.7 ma. sec. with 64 per cent falling below 50 ma. sec.

Treatment of Gonorrhea at Fitzsimons General Hospital. A Study of Cases From Sept. 1, 1938, to Oct. 31, 1940. Donald B. Peterson, and Eugene S. Beuchat.

J. A. M. A. **118**:129 (Jan. 10) 1942.

Forty-four patients received an average of one and eight-tenths fever treatments, with an average total of ten and seven-tenths hours at 106.8 to 107 F. and were cured of their gonorrhea. Three patients received an average of two treatments with an average total of eleven and four-tenths hours and were not cured by this treatment. All three refused further fever therapy. Fever therapy of 34 patients was attempted, but an adequate amount of fever could not be given because of complications. Almost all of these patients had had previous unsuccessful sulfanilamide therapy.

One hundred and seventy-eight consecutive patients were treated over a period of twenty-six months by adaptation of a routine treatment to the individual. The criteria of cure presented are not considered to be absolute, not in the class of cultural methods for example, but are criteria which are entirely practicable and have proved to be successful. The increased use of sulfanilamide and sulfapyridine therapy renders fever therapy more difficult to administer and more dangerous to the patient, but to a great extent sulfapyridine has supplanted fever therapy. The method of smear examination and evaluation adopted forms the basis of a practicable therapeutic regimen.

Irradiated Ergosterol Poisoning. Report of Two Cases. Philip A. Tumulty, and John Eager Howard.

J. A. M. A. **119**:233 (May 16) 1942.

These authors caution regarding the possible ill effects that may follow, under certain circumstances at least, the employment of massive doses of the vitamin. That vitamin D and the irradiated sterol concentrates may produce toxic reactions has been recognized for many years. Numerous writers have described the occurrence of anorexia, loss of weight, nausea, vomiting, abdominal pain, diarrhea, muscular weakness, headaches, polyuria and polydipsia in both man and animals. Acute intoxications in animals have resulted in coma and death. Only two or three deaths have been described in man. The authors present 2 cases in which a major manifestation of ergosterol intoxication of a serious nature was a prominent and interesting feature. Massive doses of irradiated ergosterol, at least under certain circumstances, present potential danger.